



Research article

Epidemiology and management of motorbike chain-related fingertip injuries: A retrospective study at B&B Hospital, Kathmandu

Sweta Jaiswal^{a,b,*}, Om Prasad Shrestha^{a,b}, Subhash Regmi^a, Santosh Batajoo^{a,b}, Niresh Shrestha^{a,b}, Ashok Kumar Banskota^{a,c}

^a Department of Orthopedics, B & B Hospital, Gwarko, Lalitpur, Nepal

^b Department of Orthopedics, Hospital & Rehabilitation Center for Disabled Children, Janagal, Kavre, Nepal

^c Hospital & Rehabilitation Center for Disabled Children, Janagal, Kavre, Nepal



ARTICLE INFO

Keywords:

Fingertip injuries
Motorbike chain injuries
Amputation
Epidemiology
Management
Retrospective study

ABSTRACT

Fingertip injuries, particularly those resulting from motorbike chain accidents, pose significant challenges due to their impact on daily life activities. This retrospective study conducted at B&B Hospital in Kathmandu from January 2018 to December 2022 aimed to explore the epidemiology and management of motorbike chain-related fingertip injuries. Among the 256 cases of fingertip injuries studied, 136 were attributed to motorbike chain accidents. Males comprised the majority of cases, and the index and middle fingers were the most frequently injured. Various surgical procedures were employed for treatment, with V-Y Plasty being the most common. These findings underscore the complexity of managing these injuries and highlight the importance of preventive measures and patient-centered care.

1. Introduction

Fingertip injuries, encompassing damage to the area distal to the insertion of the flexor digitorum deep tendon, are commonplace and frequently encountered in clinical practice [1]. These injuries, while localized to a relatively small anatomical region, involve critical structures such as the nail bed, nail plate, distal phalanx, flexor and extensor tendons, neurovascular bundle, and skin [2]. The overall function of the hand relies on a fingertip that possesses stability, mobility, and sensitivity [3]. Hand and fingers allow to carry out fine motor skills, that is to manipulate an object with precision [4]. Compared to transverse and dorsal oblique fingertip amputations, there is a limited selection of flap options for repairing volar oblique fingertip amputations [5]. Additionally, these options often result in significant donor site morbidity, particularly for dorsal oblique and certain transverse fingertip amputations [6]. Among these challenges, Atasoy's volar triangular V-Y advancement flap is widely recognized as the preferred approach [7]. Treating volar oblique injuries proves more challenging due to the absence of crucial volar skin and pulp tissue [8]. For fingertip amputations, Allen's categorization is frequently used to indicate the level of amputation. Type 1 injuries are those that simply affect the pulp. Type 2 injuries include injury to the pulp and nail bed. Type 3 injuries include distal phalangeal fractures with concomitant pulp and nail loss. Type 4 injuries involve the lunula, distal phalanx, pulp, and nail loss [9].

Despite not posing immediate life-threatening risks, injuries to these integral skeletal components can substantially compromise

* Corresponding author. Department of Orthopedics, B & B Hospital, Gwarko, Lalitpur, Nepal.
E-mail address: jaiswalsweta167@gmail.com (S. Jaiswal).

<https://doi.org/10.1016/j.heliyon.2024.e35606>

Received 7 February 2024; Received in revised form 31 July 2024; Accepted 31 July 2024

Available online 5 August 2024

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the overall quality of life [10]. The resulting functional limitations often present significant challenges in day-to-day activities, further underscoring the importance of preserving the integrity of these structures [10]. Amputation, a potential outcome of severe fingertip injuries, extends beyond its physical impact to encompass psychological and functional implications, with economic and cosmetic consequences [10–12]. Such injuries are frequently precipitated by acute traumatic events, most commonly attributed to workplace accidents and road traffic collisions. Additionally, infections can also contribute to the need for amputation [11]. Of noteworthy concern are injuries related to motorbike chain accidents, which can result in devastating consequences for the fingers due to their susceptibility to chain-related trauma. Swift medical intervention is imperative in mitigating the severity of these injuries [13]. An important facet in preventing motorbike chain-related injuries is awareness and adherence to safety precautions [14].

Despite the potential for significant morbidity and functional impairment, proactive measures can substantially reduce the occurrence of these injuries. Our study focuses on the epidemiology of motorbike chain-related fingertip injuries presented at the B&B Hospital in Kathmandu. By understanding the characteristics and circumstances of these injuries, we aim to contribute to a better understanding of preventive strategies and optimal treatment approaches.

2. Materials and methods

This retrospective study was conducted at B&B Hospital in Kathmandu, encompassing a period from January 1, 2018, to December 30, 2022. The study was conducted as per the guidelines of the institutional review committee (IRC) and formal approval was obtained (reference number: B&BIRC-23-22). The study included all patients presenting at the emergency department with motorbike chain-related fingertip injuries leading to amputation. Patients who were treated at another center, who refused to get treated or discharged and those who had missing information in their clinical records were excluded.

Patient data, including age distributions, gender, injury site, injury side, occupation, geographical distributions (rural or urban), mode of injury, treatment approaches, and complications, were extracted from electronic medical records using a paper pro forma. Fingertip amputation was classified based on Allen's Classification as type I, II, III, and IV.

2.1. Statistical analysis

Statistical Package for Social Sciences (SPSS) version 26.0 was employed to calculate descriptive statistics. Continuous data were reported in the form of mean \pm standard deviation and categorical data were reported as numbers (percentages).

3. Results

A retrospective analysis was conducted at B&B Hospital, Kathmandu, covering the period from January 2018 to December 2022, involving 256 cases of fingertip injuries that were presented to the emergency department.

Among these cases, 136 were included. These patients were all males involved in motorbike chain accidents. The age of the patients ranged from 17 to 55 years, with an average age of 29 years. Notably, the right side was more frequently affected, accounting for 74.3 % of cases, while the left side accounted for 25.7 %. The index finger had the highest incidence of injuries at 29.4 %, closely followed by the middle finger at 22.8 %. An interesting observation was made that both the index and middle fingers were simultaneously injured in 11.8 % of cases. By Allen's Classification of fingertip injuries, we categorized the cases into four distinct types. Notably, a significant

Table 1
Demographic characteristics of included patients, n = 136.

Characteristics	Frequency, n (%)
Age distributions (in years)	
<18	9 (6.6 %)
18-50	123 (90.4 %)
>51	4 (2.9 %)
Side of the injury	
Right	101 (74.3 %)
Left	35 (25.7 %)
Finger distributions	
Index	43 (31.6 %)
Middle	34 (25 %)
Ring	24 (17.6 %)
Thumb	17 (12.5 %)
Little	5 (3.6 %)
Ring + Little	5 (3.6 %)
Index + Middle	4 (2.9 %)
Index + Middle + Ring	4 (2.9 %)
Allen's classification	
Type I	9 (6.6 %)
Type II	36 (26.5 %)
Type III	63 (46.3 %)
Type IV	28 (20.6 %)

proportion, accounting for 46.3 % of the cases, fell under Allen's type III classification [Table 1]

The patients who experienced injuries related to motorbike chains sought medical attention at our emergency department, originating from a diverse range of locations. 99 were from rural areas and 37 were from urban areas. The analysis of motorbike chain injuries revealed a diverse distribution across various occupations [Fig. 1]. Students accounted for the highest percentage at 27.2 %, indicating a significant prevalence among individuals pursuing education. Businessmen represented 16.9 % of cases, signifying a notable presence in motorbike chain accidents. Sportsmen comprised 12.5 % of cases, indicating that individuals involved in sports activities also experienced such injuries. Government officials accounted for 10.3 % of cases, highlighting the occurrence of injuries among public servants. Engineers made up 8.8 % of cases, suggesting a noteworthy proportion within this profession. Both teachers and laborers contributed 6.6 % each to the cases, showing similar incidence rates in these occupational categories. Unemployed individuals represented 3.7 % of the cases. Occupations such as carpenters, farmers, painters, and artists experienced relatively lower percentages of motorbike chain injuries, with 2.9 %, 2.2 %, 1.5 %, and 0.7 %, respectively. These findings provide insights into the demographics of individuals affected by motorbike chain accidents across different occupational groups.

In a study involving 136 patients with fingertip injuries, a variety of surgical procedures were used to address the injuries [Fig. 2].

V-Y Plasty was the most common (35.3 % of cases), followed by replantation attempts (17.6 %). Cross-finger flap surgeries were performed in 12.5 % of cases, oblique triangular flap procedures in 8.1 %, full-thickness skin Grafts in 6.6 %, and thenar flaps in 5.9 %. Primary closure was used in 3.7 % of cases, while both First Dorsal Metacarpal Artery Flap and Reverse Homo-digital Island Flap procedures were employed in 2.9 % of cases each. Secondary closure and Nail bed/pulp repair each accounted for 2.9 % of cases. Abdominal flaps were the least common intervention, utilized in 0.7 % of cases [Figs. 3 and 4].

4. Discussion

There are limited studies available in the literature dealing with motorbike chain-related fingertip injuries. The sample size ranged from 40 to 50 in previously published studies [14–16]. This suggests that this study probably has the largest sample size. Previously published studies were conducted in Turkey and India, where, similar to our country, motorbikes are one of the most commonly used vehicles [15,16].

This study identified that motorbike chain-related fingertip injuries were extremely common among males, as all 136 patients were male. A study conducted in Turkey involving 42 patients with motorbike chain-related injuries had all male participants [15]. Similarly, another study conducted in India had all 40 male patients with motor-bike chain injuries [16]. This suggests that males are more prone to these injuries. It is likely to be due to the increased participation of males in the home maintenance of motorbikes due to high maintenance costs [15,16]. In addition, Poor practices of getting involved in such activities without protective gear and a lack of awareness regarding the possibility of fingertip injuries [15,16].

In this study, the right hand was most frequently involved (74.3 %), which was similar to what was reported in the literature [15, 16]. In the context of finger involvement, our finding was contrasting to what was reported in the literature. The index finger was the most commonly injured digit with a frequency of 31.6 % in our study whereas the thumb was the most commonly injured digit in both the previous studies, with a frequency of 42–60 % [15,16]. Although the exact reason behind this could not be identified, it can be assumed that there may be increased practice of deep cleaning using the index and long fingers among our population. However, the exact reason needs to be further investigated.

In this study, 17.6 % of the patients underwent replantation, and all of them did not survive. Similarly, Karahan et al. [15] replanted

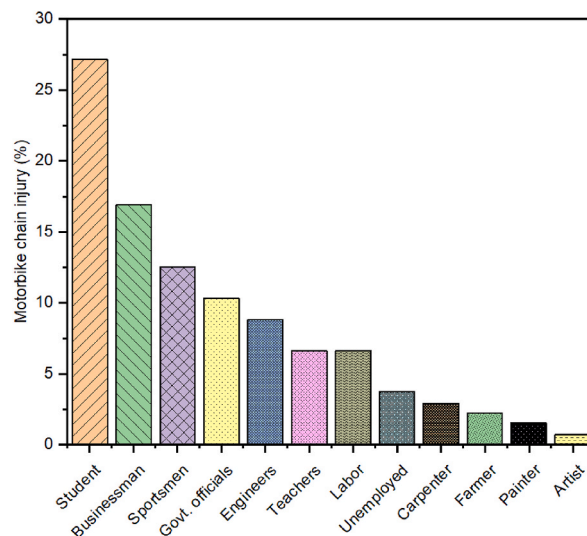


Fig. 1. Demographic information of occupations affected by motorbike chain injuries.

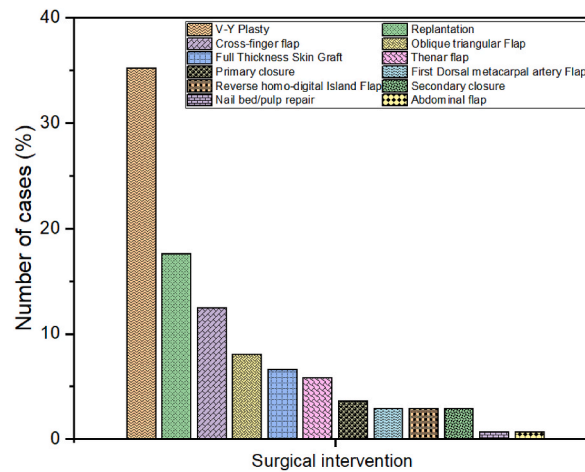
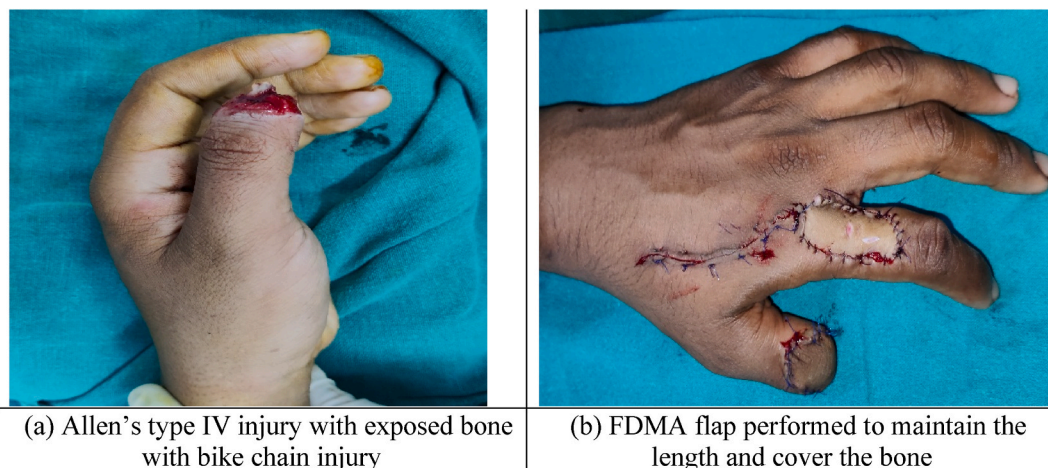


Fig. 2. Surgical procedures for fingertip injuries.



(a) Allen's type IV injury with exposed bone with bike chain injury

(b) FDMA flap performed to maintain the length and cover the bone

Fig. 3. (a) Allen's type IV injury with exposed bone with bike chain injury. (b) FDMA flap performed to maintain the length and cover the bone.

22 % of the cases, among which 66 % did not survive. In addition, Jerome et al. [16] did not perform replantation in any of the included participants. This suggests that replantation becomes extremely challenging among these injuries. The region behind that could be because of contamination with grease, as well as fractures, crush injuries, and complete fingertip avulsion [17]. In addition, especially in our part of the world, a lack of awareness regarding appropriate transportation of amputated stumps and delays in performing replantation due to resource-limited settings are some of the reasons for increased replantation failure [18,19]. Therefore, other methods of reconstruction become workhorses in managing these injuries, such as V-Y plasty, which was the most commonly performed surgery. Several local and regional flaps can be used as effective alternatives. This underscores the importance of tailoring treatment approaches to suit the distinct attributes of each injury [20].

This study has some limitations. There is a risk of selection bias as the data were collected retrospectively. This was a single-center study; so, the findings cannot provide a clear picture of the country. The listings of occupations were not tied to "risk/prevention" and were not discussed in detail because of more focus on the representation of epidemiological parameters and providing descriptive statistics. In addition, the selection of participants was not based on pre-defined categories of the study population, which could have included diverse group of population sustaining fingertip injuries. However, this resulted in the findings that the students are more involved in-home maintenance of their motorbikes sustaining these injuries.

5. Conclusions

This retrospective study provides valuable insights into the epidemiology and management of motorbike chain-related fingertip injuries at B&B Hospital in Kathmandu. The findings reveal a diverse range of injuries, with males being predominantly affected, emphasizing the need for increased awareness and preventive measures among this demographic. The high incidence of injuries involving the index and middle fingers underscores their vulnerability in motorbike chain accidents. Moreover, the variety of surgical

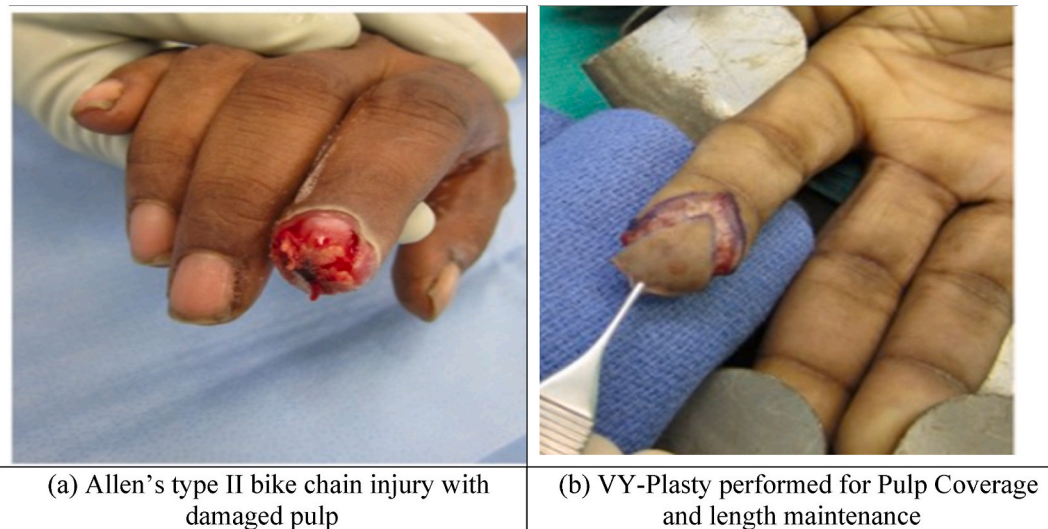


Fig. 4. (a) Allen's type II bike chain injury with damaged pulp. (b) VY-Plasty performed for Pulp Coverage and length maintenance.

techniques employed for treatment highlights the complex nature of these injuries, demanding tailored approaches for optimal outcomes. Despite surgical interventions, a notable proportion of patients experienced finger loss, emphasizing the challenges in managing such cases effectively. Thus, our study underscores the importance of proactive measures to prevent motorbike chain-related fingertip injuries and emphasizes the need for collaboration among medical professionals to improve patient care and outcomes. Further research and awareness efforts in this field hold the potential to enhance injury prevention and treatment strategies, ultimately improving the lives of individuals affected by these injuries.

Funding agency

Not funded

Data availability statement

The data that supports the findings of the study are available from the author upon reasonable request.

CRediT authorship contribution statement

Sweta Jaiswal: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Om Prasad Shrestha:** Software, Investigation, Formal analysis, Data curation. **Subhash Regmi:** Resources, Investigation, Formal analysis, Data curation. **Santosh Batajoo:** Resources, Methodology, Investigation, Data curation. **Niresh Shrestha:** Visualization, Investigation, Formal analysis, Data curation. **Ashok Kumar Banskota:** Supervision, Resources, Project administration, Investigation, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgment

The corresponding author wishes to convey heartfelt appreciation to the late Dr. Basanta Mathema, a Plastic Surgeon, for his guidance. He was Consultant Department of Plastic Surgery, B & B Hospital, Gwarko, Lalitpur, Nepal & Hospital & Rehabilitation Center for Disabled Children, Janagal, Kavre, Nepal.

References

- [1] C.R. McCash, Finger-tip injuries, *Br. Med. J.* 2 (1961) 1021, <https://doi.org/10.1136/bmj.2.5258.1021-b>.
- [2] A. Kawaiyah, M. Thakur, S. Garg, S.H. Kawasmi, A. Hassan, Fingertip injuries and amputations: a review of the literature, *Cureus* 12 (2020).

- [3] S.H. Woo, Y.W. Kim, H.J. Cheon, H.J. Nam, D.H. Kang, J.M. Kim, H.C. Ahn, Management of complications relating to finger amputation and replantation, *Hand Clin.* 31 (2015) 319–338, <https://doi.org/10.1016/J.HCL.2015.01.006>.
- [4] V. Giustino, A. Patti, L. Petrigna, F. Figlioli, E. Thomas, V. Costa, L. Galvano, J. Brusa, D.S.S. Vicari, S. Pajaujieni, Manual dexterity in school-age children measured by the Grooved Pegboard test: evaluation of training effect and performance in dual-task, *Heliyon* 9 (2023) e18327.
- [5] K. Cevik, A. Arik, M.M. Eskandari, Outcomes of bipedicle VY 'cup' flap for repair of volar oblique fingertip amputations, *J. Hand Surg.* 48 (2023) 144–149.
- [6] J.B. Tang, D. Elliot, R. Adani, M. Saint-Cyr, F. Stang, Repair and reconstruction of thumb and finger tip injuries: a global view, *Clin. Plast. Surg.* 41 (2014) 325–359.
- [7] S.S. Chakraborty, P.C. Kala, R.K. Sahu, P.K. Dixit, D. Katrolia, S. Kotu, Fingertip amputation reconstruction with VY advancement flap: literature review and comparative analysis of atasoy and kutler flaps, *World J. Plast. Surg.* 10 (2021) 8.
- [8] J.W. Snow, The use of a volar flap for repair of fingertip amputations: a preliminary report, *Plast. Reconstr. Surg.* 40 (1967) 163–168, <https://doi.org/10.1097/00006534-196708000-00010>.
- [9] S. Masaki, T. Kawamoto, Fingertip amputation injury of allen type III managed conservatively with moist wound dressings, *Am. J. Case Rep.* 22 (2021) e928950, <https://doi.org/10.12659/AJCR.928950>, 1.
- [10] S.A. Samantaray, J. Oommen, C.V. Thamunni, K. Kalathingal, H.M. Koyappathody, S.M. Shet, S. Joseph, R.V. Pydi, Fingertip injury epidemiology: an Indian perspective, *J. Plast. Surg. Hand Surg.* 56 (2022), <https://doi.org/10.1080/2000656X.2021.1962332>.
- [11] F.J. Pencle, R. Doehrmann, M. Waseem, Fingertip injuries, *StatPearls* (2017).
- [12] S. Saraf, V. Tiwari, Fingertip injuries, *Indian J. Orthop.* 41 (2007) 163–168, <https://doi.org/10.4103/0019-5413.32051>.
- [13] A.J. Miller, M. Rivlin, W. Kirkpatrick, J. Abboudi, C.M. Jones, Fingertip amputation treatment: a survey study, *Am. J. Orthoped.* 44 (2015) E331–E339.
- [14] J. Terrence Jose Jerome, Reposition graft technique for motorcycle chain injury fingertip amputations: experience with 50 patients, *J. Hand Surg. Eur.* 46 (2021) 422–424, <https://doi.org/10.1177/1753193420960352>.
- [15] G. Karahan, K. Yamak, M. Demirkoparan, T. Altay, L. Kucuk, An uncommon injury: motorcycle chain injury of the hand, its socioeconomic outcome, and prevention, *Orthop. Traumatol. Surg. Res.* 108 (2022) 102800, <https://doi.org/10.1016/j.otsr.2020.102800>.
- [16] J.T.J. Jerome, Reconstruction of motorcycle spokes wheel injury fingertip amputations with reposition flap technique: a report of 40 cases, *Eur. J. Trauma Emerg. Surg.* 48 (2022) 573–584, <https://doi.org/10.1007/s00068-020-01462-6>.
- [17] S.-B.H.S.A. Mehri N, Epidemiological and Clinical Characteristics of Traumatic Hand and Finger Amputations in North Western Iran; a Single Center Experience., (n.d.).
- [18] M.S.A. Beg, Sheeraz-Ur-Rahman, S. Yasmeen, A. Bawa, B. Urooj, Experience in the management of finger tip injuries at a tertiary care hospital in Karachi, *Med. Forum Mon.* 28 (2017).
- [19] A.P. Jayachandiran, S.V. Bose, S.R.V. Mahipathy, A.R. Durairaj, N. Sundaramurthy, P. Suresh, Epidemiological study of fingertip injuries in a tertiary care center in kancheepuram district, India, *J. Pharm. Res. Int* (2021), <https://doi.org/10.9734/jpri/2021/v33i63a35238>.
- [20] H.J.H. Ng, J. Yuan, V. Rajaratnam, Management of fingertip injuries: a survey of opinions of surgeons worldwide, *J. Hand Microsurg.* 14 (2022) 70, <https://doi.org/10.1055/S-0040-1713072>.