An Analysis of Grinder Cut Injuries Among Patients Admitted to the Accident Services at National Hospital of Sri Lanka

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Abstract

The evaluation of grinder cut injuries is crucial for ensuring effective care, minimizing complications, and facilitating recovery. It also helps to alleviate financial burdens on both employees and employers by identifying susceptibility factors, assessing injury severity, and planning appropriate treatment. In the literature it is evident that grinder cut injuries are a significant component of reporting severe injuries, highlighting the need for focused investigation.

This descriptive cross-sectional study aims to explore the characteristics and injury patterns of patients admitted to the Accident Service Department at the National Hospital of Sri Lanka due to grinder cut injuries. Our findings indicate that 23.9% of affected individuals are aged between 31 and 40 years, with 66.1% falling within the broader age range of 31 to 60 years. The peak incidence of injuries occurred at the age of 34 years, with 338 (80.1%) injuries sustained at the workplace. Notably, 224 (53.1%) patients had over five years of employment experience, with many categorized as temporary workers. Among the injuries studied, 243 (57.6%) were classified as non-grievous, while 1.9% presented life-threatening conditions. Alarmingly, 384 (90.9%) patients did not possess personal or workplace insurance coverage.

Based on these findings, we recommend the implementation of continuous training programs and enhancements to workplace safety protocols to mitigate the risk of grinder-related injuries effectively.

Key words: Grinder-cut injuries, Occupational injuries, occupational safety

Introduction

Occupational safety has become a critical concern in the context of industrialization, with properly managed settings demonstrating a notable reduction in occupational injuries. Conversely, poorly managed industrialization often exacerbates health hazards in the workplace. Analyzing workplace injuries is essential for both employers and health sectors to implement proactive safety measures. Advances in engineering controls, personal protective equipment, and improved machinery have contributed to lowering the incidence of occupational injuries. Furthermore, fostering a safety culture within organizations has further enhanced these improvements.

According to a study by Poghosyan et al. (2020), the International Labor Organization (ILO) estimates that approximately four percent of the world's gross domestic product is lost annually due to work-related accidents and diseases. The construction sector, in particular, experiences a fatal injury rate approximately 3.5 times higher than the overall industry average. Additionally, research conducted in India reveals that agricultural injuries account for 73 percent of hand injuries (G. et al., 2017).

Grinder cut injuries represent a significant concern within occupational safety, especially given their prevalence in accident service units. A study conducted in Australia highlights those accidental injuries from power tools, such as angle grinders, have become a major burden on the healthcare system, underscoring the need for improved understanding of injury trends to inform prevention strategies (Judge et al., 2019). Angle grinders, which utilize high-speed discs for cutting and grinding, can result in severe injuries, particularly to the face and upper limbs, if not handled safely.

Research from Norway indicates that the majority of patients suffering from grinder cut injuries fall within the 21-30 age group, with right-handed individuals being disproportionately affected (Ravikumar et al., 2017). The high rotational speeds of grinder discs, which can reach up to 6000 revolutions per minute, contribute to the severity of these injuries, often affecting the head, neck, and upper limbs, while injuries to the lower trunk are less common (Carter et al., 2008).

Identifying the factors associated with grinder cut injuries is critical to formulating effective prevention strategies. Despite the pressing nature of this issue, there is a notable lack of data available to health planners in Sri Lanka to support the development of targeted interventions. As rapid urbanization continues, it is vital to synchronize time, quality, and financial resources to maximize cost-effectiveness in occupational health.

This article aims to analyze the associated factors and injury patterns among individuals admitted to the Accident Service at the National Hospital of Sri Lanka due to grinder cut injuries. Specifically, the study seeks to identify sociodemographic factors, predisposing and associated factors contributing to these injuries, and the overall pattern and consequences of such injuries. Understanding these elements is essential for guiding health authorities and organizations in mitigating risks and enhancing workplace safety.

The assessment of injury causes remains a crucial responsibility for both companies and health authorities at national and local levels (De Merich et al., 2022). High-speed angle grinder disks pose a severe risk, as they can inflict disfiguring and permanent injuries or even fatalities (Carter et al., 2008). Given that grinder cut injuries can occur due to various factors—including kickback from the cutting surface and the use of incorrect or worn discs—there is an urgent need for further research and effective safety measures (Carter et al., 2008).

Methodology.

The study was conducted at the National Hospital of Sri Lanka (NHSL), the country's largest teaching hospital that provides tertiary-level healthcare services. With a dedicated staff of approximately 131 consultants, 880 medical officers, and 2,317 nursing officers, the NHSL caters to patients around the clock. The focus of this research was specifically on the Accident and Emergency Services Unit. Utilizing a descriptive cross-sectional study design, the research aimed to assess patients who suffered from grinder cut injuries and were admitted to the Accident Service at NHSL. Over a three-month period from April to June, a total of 487 patients, averaging 162 admissions per month, were identified with varying degrees of injury. The study spanned eight months in total, following the acquisition of ethical approval.

The target population for this study included patients with grinder cut injuries admitted to the Accident Service at NHSL. During the months of April, May, and June, a total of 487 patients (averaging 162 patients per month) with varying degrees of injury were admitted.

The sample size was determined using the formula outlined by Chin & Lwanga. (1991) and the calculated sample size was 384. Accounting for a 10% non-response rate, the total sample size was adjusted to 422. Simple random sampling was carried out by selecting patients with grinder cut injuries from the admission registers in wards 72 and 73 until the required number was attained.

Inclusion criteria encompassed all patients admitted to the Accident Service who were capable of providing a proper history during their hospital stay. Conversely, victims who were unable to give detailed histories due to the severity of their trauma were excluded from the study.

To address specific objectives, an interviewer-administered questionnaire was utilized to gather information on demographic factors and predisposing variables. Additionally, the principal investigator or a trained assistant conducted observational assessments, and secondary data were reviewed to identify injury patterns and their consequences. Patients were interviewed during their hospital stay, focusing on their injuries upon admission. All collected data was treated with strict confidentiality. Comprehensive measures were instituted to ensure complete data acquisition. The hard copies of the questionnaires were securely stored under the principal investigator's custody. Data entry was performed in Microsoft Excel, while data processing, including data cleansing and conversion of continuous data to categorical data, was conducted by the principal investigator. The latest SPSS software was utilized for statistical analysis.

In this study, we operationalized several key variables to better understand the factors influencing injury patterns and their consequences.

Basic Demographic Characteristics included age, measured in years, and the place of injury, classified as either the workplace or home. Predisposing and Associated Factors were assessed through the duration of training and experience, categorized by tenure and employment status as permanent or non-permanent. Additionally, we examined the type of substance abuse, which was classified into categories of Smoking, Alcohol, Other substances, and None. Injury Patterns were explored through the nature of the injury, including categories such as Aberration, Contusion, Laceration, cut injuries, and Fractures, along with the site of injury, which encompassed Head and Neck, Chest and Abdomen, and Hands and Legs. Lastly, we addressed the Consequences of Injury by evaluating the duration of disability, classified as Temporary or Permanent, as well as the impact on job performance, categorized as Permanent loss or Temporary loss.

This comprehensive operationalization allows for a detailed analysis of the relationships between these variables and the implications for injury severity and recovery.

Ensuring Data Quality:

To enhance data quality and validity before analysis, several steps were taken. The questionnaire underwent a pre-testing process and was refined accordingly to ensure reliable responses. The significance of the study was communicated to both the staff and the patients involved. Data collection was performed on a voluntary basis and supervised by trained personnel. The principal investigator provided training for data collectors to mitigate inter-enumerator variability and was available throughout the data collection process to support both data collectors and patients.

Administrative and Ethical Considerations

Administrative approval for the study was obtained from NHSL prior to its commencement. Furthermore, ethical clearance was secured from the Ethics Review Committee at the Post Graduate Institute of Medicine in Colombo. Written informed consent was acquired from all participants, who were informed about the study's nature, expectations, and the measures in place to ensure confidentiality. Interview arrangements were structured to preserve the privacy of the respondents.

Results

The majority of the patients presenting with grinder cut injuries are between 31 and 40 years (23.93%) of age. Out of all the grinder cut injuries 66.11% belong to age group of 31 to 60 years. Most of the grinder cut injuries occurred at 34 years of age. The majority of the grinder cut injuries 338 (80.09%) occurred at their workplaces. Most of the patients 224 (53.08%) admitted with grinder cut injuries have worked in their workplace for more than 5 years. Further most of them are temporary workers. Alcohol is the main substance 89 (21.09%) that they have consumed at the time of the injury. Most of them (49.53%) had not consumed any substance at the time of the injury.

The majority of the patients 384(90.99%) with the grinder cut injuries didn't have personal or workplace insurance. Summary of socio-demographic characteristics is given in table 1.1.

Table 1.1. Socio-demographic characteristics of the patients

Variable	Frequency	Percentage
Age group (Years)		
1-10	0	0.0
11-20	38	9.00
21-30	54	12.80
31-40	101	23.93
41-50	81	19.19
51-60	97	22.99
61-70	35	8.29
71-80	16	3.79
Total	422	100
Place of the incident		
Workplace	338	80.09
Home	84	19.91
Total	422	100
Number of years worked		
< 1	36	8.53
1-5	162	38.39
>5	224	53.08
Total	422	100
Substance abuse at the time of the injury		
Smoking	87	20.61
Alcohol	89	21.09
Other	37	8.77
Non	209	49.53
Total	422	100
Availability of insurance		
Insured	38	9.00
Noninsured	384	90.99
Total	422	100

Most of the patients 235(55.69%) presented with cut injuries whereas only 18(4.26%) presented with bone fractures. Out of all the injuries the commonly affected sites (76.07%) are the limbs. The majority of the injuries 243(57.58%) are non-grievous injuries. Out of all injuries 1.90 injuries have been endangering life. Temporary disability was evident in 371(87.91%) of the patients whereas only 12.06% was suffering from the permanent disability. Out of all the injured patients only 1.90% of patients lost their job permanently due to the injury. Summary of the clinical characteristics is given in table 1.2

Table 1.2 Clinical characteristics of the injury

Variable	Frequency	Percentage
Type of wound		
Contusion	42	9.95
Laceration	127	30.09
Cut	235	55.69
Fracture	18	4.26
Total	422	100
Injury site of the body		
Head	47	11.14
Chest	54	12.80
Limbs	321	76.07
Total	422	100
Severity		
Non grievous	243	57.58
Grievous	171	40.52
Endangering life	8	1.90
Total	422	100
Prognosis of the disability		
Temporary disability	371	87.91
Permanent disability	51	12.06
Total	422	100
Capability of performing job after the injury		
Lost permanently	8	1.90
Lost temporary	414	98.10
Total	422	100

Discussion

Smooth performance and organizational productivity depend on having a healthy workforce, particularly one that is free from accidents. In Sri Lanka, three major factors contributing to accidents were identified and their relationships were evaluated. A study conducted in the Central Province of Sri Lanka pointed out safety conditions, working conditions, and job stress as the main areas of concern (Senavirathne & Kularathne, 2020). Identifying the root causes of injuries can help prevent their recurrence in the workplace, and analyzing injuries can reduce critical risk factors (De Merich et al., 2022).

A study by the Royal Society for the Prevention of Accidents (RoSPA) covering data from the years 2000 to 2002 utilized the Home and Leisure Accident Surveillance System (HASS/LASS) (Carter et al., 2008) and found that grinder-related cutting injuries ranked as the third most common tool-related injury, with an average of 5,400 injuries occurring each year.

This research examined injury patterns, severity, availability of insurance, and the prognosis of disabilities among patients admitted to the Accident Service Department at the National Hospital of Sri Lanka. Among the 422 participants, the majority of those with grinder injuries were aged between 31 and 40 years (23.93%). Notably, 66.11% of grinder injuries occurred in individuals aged 31 to 60 years, with the most common age being 34 years. In a contrasting study on angle grinder injuries to the forearm and hand the mean age of affected individuals was found to be 39 years, with 22% of patients under 45 years and 14% over 60 years (Arık et al., 2021).

When evaluating where grinder injuries took place, 19% of accidents were domestic, while 80% occurred in the workplace. In contrast, a study conducted in Nepol reported that 40.6% of injuries occurred at home while only 12.2% occurred at workplace (Thapa et al., 2020). However, this study analyzed all types of injuries presented to the emergency department of the tertiary care hospital demonstrating a notable difference.

Most patients (53%) with grinder injuries had more than five years of experience using the tool, while only 8% had less than one year of experience. This raises questions regarding the argument that inexperience leads to grinder injuries.

According to the study, only 21% of workers were under the influence of alcohol at the time of their injuries. However, no studies have directly evaluated the relationship between substance abuse and grinder cut injuries.

Among the injuries analyzed, 55.6% were classified as cut injuries; yet, there has been a lack of detailed assessment of grinder cut injuries in Sri Lanka regarding lacerations and bone fractures. Furthermore, no international publications have examined these injury patterns descriptively.

Approximately 76% of injuries among study participants were limb injuries, with 87% involving the hand and forearm. A retrospective study evaluating injuries from 2011 to 2018 found that 46.4% involved the hand and 23% involved the head (Song et al.,2022).

The majority of injuries (243 or 57.58%) were classified as non-grievous, while 1.90% of injuries were life-threatening. Another study noted that the shape of the wound follows the cutting disk, with the size of the wound depending on the disk's size (Sudhoff et al., 2020).

Around 91% of patients lacked insurance coverage for their injuries, forcing them to bear all related costs themselves. According to a study it was revealed that only 32.6% lacked insurance coverage among injured (Englum et al., 2011). This study was conducted in USA utilizing national Trauma data Bank data the existing difference in insurance cover may be due to the differences in heath system and the socio-economic status of two countries.

The injuries resulted in permanent disability for 12% of individuals, while 88% experienced reversible injuries.

In this study, we provide several recommendations aimed at enhancing workplace safety for employees using angle grinders, irrespective of their experience or age. We suggest conducting training programs to raise awareness and promote safe usage practices. Additionally, we recommend the provision of equipment featuring updated safety measures and the establishment of a strict policy against substance abuse during working hours. Employers are also encouraged to insure their employees against work-related injuries. It is noteworthy that most patients examined experienced only minor injuries and sought treatment at outpatient departments without requiring hospitalization. An evaluation of this group of patients would have offered valuable insights for the study.

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