

**Indian Internet Journal of Forensic
Medicine and Toxicology
Year 2025, Volume-23, Issue-2 (Jul-Dec)**



Profile of deaths due to electrocution– a retrospective study conducted at a tertiary care hospital in Haryana

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ARTICLE INFO

Keywords:

Electrocution, Electrical Injury, Accidental, Exit and entry wound, Rainy season.

doi: 10.48165/ijffmt.2025.23.2.7

ABSTRACT

Background- Deaths due to electrocution have been on an increase due to extensive use of modern electrical appliances in day-to-day work. Electrical burns are associated with severe morbidity and high mortality. However, these are preventable if proper safety measures are taken while using them.

Methods- This study took into account 61 post-mortem records of cases conducted in 7 years and analysed cases of deaths caused by electrocution in the region.

Results- Of the 61 cases most common occurrence of deaths by electrocution was seen in rainy season and most commonly affected areas were upper extremities.

Conclusion- The study highlights that the death caused by electrocution are not so common and also avoidable if proper care is taken while working around electrical appliances. Safety measures should be instructed properly to avoid such hazards.

Introduction

Electricity is a fundamental component of modern life but poses significant hazards, such as electrical burns and electrocution, contributing to morbidity and mortality. Most electrocution fatalities are accidental, with many individuals exposed to electrical energy daily ^(1,2). Despite general awareness, few people realize that even small amounts of electrical energy can be fatal. For example, the current from a small 7.5 W, 120-volt lamp can be lethal if passed through the chest ^(3,4)

Household currents are often mistakenly considered harmless, and power lines, assumed to be insulated, can cause fatalities ⁽⁵⁾. Electrocution can result from contact with

both low- and high-voltage currents, with most fatalities occurring from low-voltage currents. In India, the power system typically uses AC 220–240 V, 50 A, common in residential and minor industrial settings, underscoring the importance of understanding and mitigating risks to prevent electrocution incidents ⁽⁶⁾.

When an electric current passes through the body, it can cause damage through several mechanisms. The severity of injury depends on the path the current takes through the body, the type and intensity of the current, and the duration of exposure ⁽¹⁾. Electrical injuries can disrupt normal cardiac function, potentially leading to arrhythmias, cardiac arrest, or myocardial necrosis. The current can also cause thermal injuries, leading to burns both externally and internally, as

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well as muscle damage and compartment syndrome. Nerve and tissue damage occurs as electric energy is converted to heat, and high-voltage currents can result in extensive, deep burns. Additionally, the violent muscle contractions caused by the current can result in fractures or dislocations^(1,4).

Fatal injuries caused by electricity can be challenging for forensic pathologists during autopsies. One key indicator of a fatal electric injury is an electrical mark, which is often the only evidence of contact with electricity. The prevalence and appearance of these marks can vary significantly. Due to the potential absence of distinctive morphological findings, determining electrocution as the cause of death often involves excluding other possible causes and relying on circumstantial evidence collected at the scene of the incident.

The epidemiology of electrical fatalities in the Sonipat region in Haryana, India, from 2016 to 2022, underscores the severity of occupational and domestic electrocutions. This study identifies risk factors for fatal injuries and offers recommendations for effective safety programs to mitigate the risk of electrocution. It aims to be a valuable resource for safety and public health professionals, trainers, researchers, and others involved in preventing accidental electrocutions.

Material And Methods

The research was carried out in the Department of Forensic Medicine at B.P.S. Government Medical College for Women, Khanpur Kalan, Sonipat. This descriptive retrospective study involved collecting data from post-mortem records of all electrocution-related deaths brought to the mortuary of B.P.S. Government Medical College for Women, Khanpur Kalan, Sonipat, from January 2016 to December 2022.

A standardized proforma, specifically designed for this study, was used to extract details from the post-mortem records and police documents. Information such as age, gender, season, location of the incident, entry and exit wounds, and cause of death was collected for each case.

Inclusion criteria:

All the cases brought to mortuary of BPS Government Medical College for Women, Khanpur Kalan, Sonipat for post mortem examination who died due to electrical injury.

Exclusion criteria:

1. Cases where body was decomposed.
2. Cases of lightning.

The data collected was then thoroughly analysed to obtain a comparative evaluation.

Result

From January 2016 to December 2022, a total of 61

electrocution cases were reported at the mortuary of BPS Government College for Women, Khanpur Kalan, Sonipat. The majority of these cases involved males, accounting for 53 (86.8%) of the total, while females comprised only 8 (13.2%) cases.

The highest number of cases occurred in 2017, with 15 (24.59%) incidents, whereas 2019 saw the fewest cases, with only 4 (6.55%). The age group most affected was 21 to 40 years, representing 34 (55.74%) of the total cases. Notably, there were no cases reported in the age more than 80 years.

The peak incidence of cases was in the month of July (17 cases), followed by June and August (10 cases each), which coincide with the rainy season in Haryana. The upper limbs were the most common site for entry wounds, while the feet were the most common site for exit wounds.

Discussion

This retrospective study of 61 electrocution-related deaths autopsied at B.P.S. Government Medical College for Women, Khanpur Kalan, Sonipat from January 2016 to December 2022 adds region-specific epidemiological data and highlights patterns that are important for both preventive public health measures and forensic practice. The findings — predominance of young adults (21–40 years), male preponderance, peak incidence during the monsoon months, and frequent involvement of the upper limbs as entry sites — are consistent with several hospital- and population-based studies from India and also other regions.

Age distribution in our series showed that 55.74% of victims were in the 21–40 year age group, indicating that working-age adults are disproportionately affected. This parallels observations by Shaha et al⁽⁷⁾, Bharath et al⁽⁸⁾ and Gupta et al⁽⁹⁾, and is further supported by larger series such as Behera C et al⁽¹⁰⁾ which similarly report high incidence among young manual workers and electrical trades. These data collectively suggest that occupational exposure and activity-related risk behaviour are major contributors to fatal electrical injuries, underscoring the need for targeted occupational safety training and enforcement.

The predominance of male victims in the study aligns with global trends, where males are more frequently involved in electrocution incidents due to their higher likelihood of working in occupations with increased exposure to electrical hazards. In this study, 74% of the victims were male, while 26% were female, indicating a male gender preponderance similar to other studies conducted by Arora et al⁽¹¹⁾ and Selvakumar et al⁽¹²⁾ is further supported by hospital-based observations from Gaur et al⁽¹³⁾.

Seasonal variations in the incidence of electrocution deaths, with a peak during the rainy months, suggest that environmental factors play a crucial role in these fatalities. The increased moisture during the rainy season likely

enhances the conductivity of electrical currents, leading to a higher incidence of electrocution. The highest number of fatalities in our study occurred in July (27.87%), followed by June and August (16.4%). This is due to the lower resistance of wet skin (200-300 ohms) compared to dry skin (around 1000 ohms). These findings are consistent with studies by Fatovich⁽¹⁴⁾ in 1992, Bailey et al⁽¹⁵⁾ in 2001, and Rautji et al⁽¹⁶⁾ in 2015. Case reports and forensic series by Shetty BSK et al⁽¹⁷⁾ have described outdoor monsoon-related electrocutions where conductive waterlogged surfaces and fallen or exposed conductors were implicated. Public health advisories, focused infrastructure maintenance prior to and during the monsoon, and community education about avoiding contact with electrical installations during wet conditions could reduce monsoon-associated fatalities. Recent institutional analyses, including the study by Prasad et al⁽¹⁸⁾ and Karthikeyan et al⁽¹⁹⁾ also demonstrate monsoon-related mortality peaks, underscoring the need for timely electrical infrastructure assessment before and during the rainy season.

The study also reveals that the upper limbs are the most common site for entry wounds, while the feet are the most common site for exit wounds. This pattern suggests that many electrocution incidents occur when individuals come into contact with electrical sources using their hands, and the current then travels through the body to exit via the feet. This is because the feet are usually in contact with the ground, providing a pathway for the current to exit the body. Consequently, electrocution in postures other than standing may result in different entry and exit wound sites. This finding is similar to the results of the study conducted by Shaha et al⁽⁷⁾ and Gupta et al⁽⁹⁾. Clinicalmedicolegal data from large autopsy series Shrigiriwar et al., 2007⁽²⁰⁾ illustrate that victims often lack extensive external burns or clear exit wounds, yet succumb rapidly — supporting that even contact-current, possibly via hand-to-foot pathways, may result in fatal electrocution. These observations highlight the need for the use of personal protective equipment such as insulated gloves and footwear in occupational settings.

Furthermore, the misconception that household currents are not dangerous or that power lines are insulated and safe is alarmingly common. Public education campaigns should focus on dispelling these myths and emphasizing the potential lethality of even low-voltage electrical currents. Simple safety measures, such as using circuit breakers, ensuring proper insulation, and avoiding contact with electrical sources during wet conditions, can significantly reduce the risk of electrocution⁽⁹⁾.

Overall, the demographic trends, seasonal patterns and injury mechanisms observed in our study mirror the recurring themes documented across multiple Indian and international datasets, underscoring that most electrocution deaths are preventable with appropriate safety practices, infrastructural maintenance and public awareness—an

observation consistently highlighted in foundational literature such as that by Cooper⁽²¹⁾.

Conclusion

Electrocution continues to be a major public health issue in India, leading to significant morbidity and mortality. This study highlights the critical need for improved safety measures and public awareness campaigns to reduce the risks associated with electrical injuries. The predominance of accidental electrocution fatalities underscores the necessity for preventive strategies in both domestic and occupational environments.

The data indicates that young adults, particularly males, are most affected, with a notable rise in incidents during the rainy season. This seasonal pattern suggests the need for targeted interventions during high-risk periods. Additionally, the frequent occurrence of entry wounds on the upper limbs and exit wounds on the feet points to specific patterns of electrical contact that could inform safety training and protective measures.

To decrease the incidence of electrocution-related deaths, it is essential to implement comprehensive safety programs, enforce strict regulations, and promote education on the dangers of electricity. Addressing these factors can significantly reduce fatalities and enhance overall public safety.

Funding

Nil

Conflict of interest

Nil

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Tables & Figures

Age	No. of Cases	Percent
1-20	11	18.03
21-40	34	55.74
41-60	14	22.96
61-80	02	3.27
>80	00	00
TOTAL	61	100

Table 1 showing age-wise distribution of the cases.

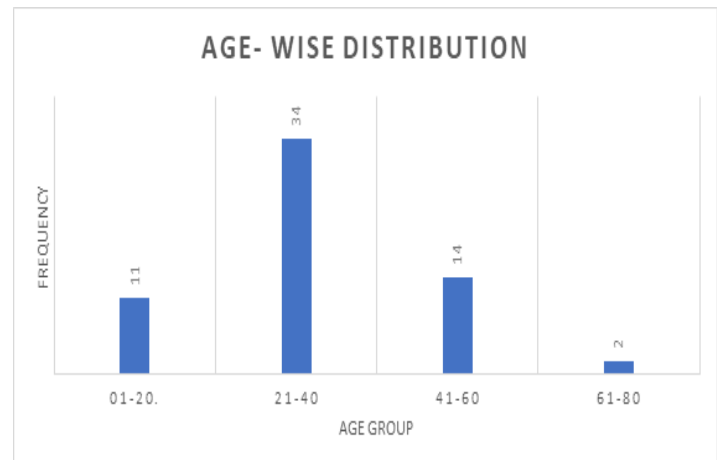


Figure 1 showing age-wise distribution of the cases.

Year	No. of Cases	Percent
2016	12	19.67
2017	15	24.59
2018	10	16.39
2019	04	06.55
2020	06	09.83
2021	05	08.19
2022	09	14.75
TOTAL	61	100

Table 2 showing year wise distribution of the cases.



Figure 2 showing year-wise distribution of the cases.

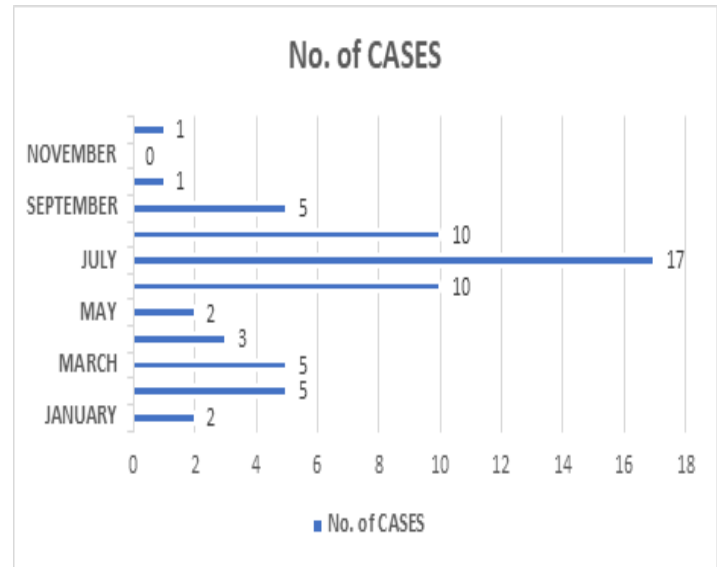


Figure 5 showing distribution of the cases based on months.

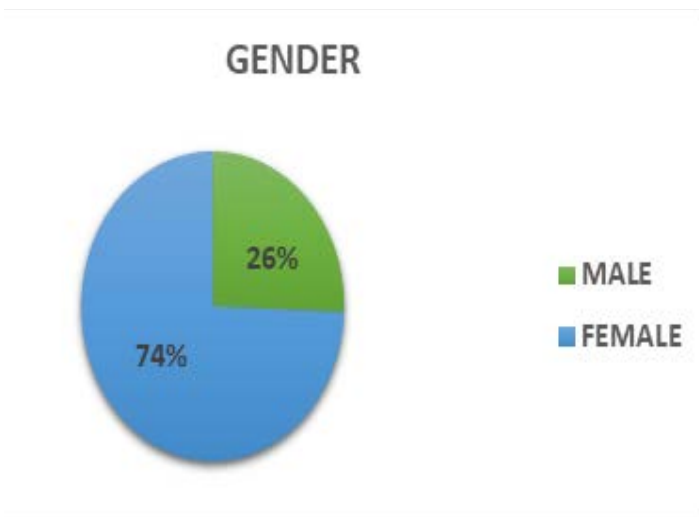


Figure 3 showing distribution of the cases based on gender.

Part of Body	No. of Cases	Percent
Head, Neck and Face	03	4.92
Chest	11	18.03
Abdomen	06	9.84
Upper Limbs	40	65.57
Lower Limbs	27	44.26
No Lesion	09	14.75

(* - one or more body parts can be involved simultaneously)

Table 3 showing distribution of cases according to body part involved.

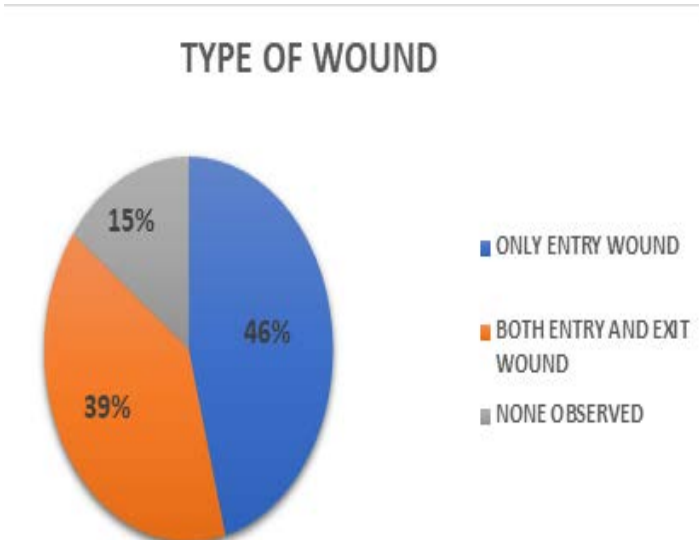


Figure 4 showing distribution of the cases based on presence of entry, exit or both wounds.