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## A Study of Electrocution-Related Deaths: An Autopsy-Based Analysis at SMS Medical College and Hospital, Jaipur During the year 2023-24

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### ABSTRACT

**Background:** Electrocution is a largely preventable cause of mortality but continues to be a significant medico-legal and public health issue in India. It commonly occurs due to accidental contact with live wires, faulty appliances, or unsafe occupational practices, with suicidal and homicidal cases being rare.

**Aim:** To analyze the demographic profile, injury patterns, and medico-legal aspects of electrocution-related deaths at SMS Medical College, Jaipur, during 2023–2024.

**Methodology:** This observational study was conducted from November 2023 to October 2024 in the Department of Forensic Medicine, S.M.S. Medical College, Jaipur. A total of 100 medico-legal autopsy-confirmed cases of electrocution deaths were included after ethical approval and consent from legal heirs. Cases suspected but not confirmed on postmortem and decomposed bodies were excluded. Data were analyzed with respect to demographic details, site of injury, wound characteristics, voltage, associated burns, and cause of death.

**Result:** Males predominated (89%) with only 11% females. The most affected age group was 20–29 years (37%), followed by 30–39 years (26%). Rural victims constituted 55% of cases. Hindus formed the majority (82%), reflecting regional demographics. The limbs were the most common sites of injury (lower limb 77%, upper limb 62%). Entry and exit wounds were noted in 52%, while 8% showed no external marks. Low-voltage exposure accounted for 68% of deaths, and flame burns were seen in 48% of cases. Septicemia was the leading cause of death (55%), followed by shock due to electrocution (38%).

**Conclusion:** Electrocution deaths predominantly affect young rural males engaged in high-risk occupatio

ns. Most fatalities result from low-voltage exposure and septicemia following burns. The findings emphasize the importance of public awareness, enforcement of workplace safety standards, and meticulous medico-legal autopsy to prevent and correctly identify electrocution deaths.

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## INTRODUCTION

Electrocutation, defined as death due to the passage of electric current through the body, is a largely preventable cause of mortality but continues to pose a major public health and medico-legal challenge in India. The majority of cases are accidental, usually resulting from contact with live wires, defective household appliances, or unsafe occupational practices, while suicidal and homicidal electrocution are rare<sup>[1-5]</sup>. According to the National Crime Records Bureau (NCRB), nearly 1.1 lakh people died from electrocution in India between 2011 and 2020, with daily averages of about 30 deaths. Annual fatalities rose from 8,945 in 2011 to 13,446 in 2020, before declining slightly to 12,529 in 2021, underscoring the persistent burden<sup>[6]</sup>. Autopsy-based studies from Gujarat, Delhi, Coimbatore, and Ballari reveal a consistent pattern: young adult males (20–40 years) form the majority of victims, primarily due to occupational exposure in construction, agriculture, and electrical work<sup>[1-4]</sup>. A similar trend has been documented at SMS Medical College, Jaipur, where over 90% of victims were males, mostly from rural and lower socio-economic backgrounds<sup>[7,10]</sup>. A recent study from Bhopal also confirmed male predominance, with 63% of incidents occurring in workplaces and seasonal peaks during the monsoon months<sup>[8]</sup>. The medico-legal importance of electrocution lies in its varied presentation. Typical findings include entry and exit wounds, electrical burns, and metallization, but in some cases no external injury is evident, requiring meticulous internal examination. Death is usually caused by ventricular fibrillation, cardiac arrest, or respiratory paralysis<sup>[5,9]</sup>. The present study was therefore undertaken to analyze the demographic profile, injury patterns, and medico-legal aspects of electrocution deaths in Jaipur, contributing region-specific data to guide preventive strategies.

**AIM-** To analyses the demographic profile, injury patterns, and medico-legal aspects of electrocution-related deaths at SMS Medical College, Jaipur, during 2023–2024.

**Methodology** - This observational study was carried out at the mortuary of the Department of Forensic Medicine, S.M.S. Medical College and Hospital, Jaipur, after obtaining approval from the Institutional Ethics Committee. A total of 100 confirmed electrocution deaths were included. Only those cases where death was clearly due to electrical injury and where medico-legal autopsy was performed at SMS Hospital were taken. Consent was obtained from the legal heirs before inclusion. Cases where electrocution was only suspected but not confirmed on post-mortem examination, as well as decomposed or mutilated bodies, were excluded.

## OBSERVATION & RESULTS

**Table 1: Distribution of Subjects According to Sex**

Gender	Number of Subjects	Percentage
Male	89	89 %
Female	11	11 %
Total	100	100.00

In this study of 100 electrocution-related deaths, **males accounted for 89%** while **females comprised only 11%**. The marked male predominance can be explained by their higher occupational exposure, as men are more frequently engaged in construction, electrical, industrial, and agricultural work, which carry greater risks of accidental contact with live wires and high-voltage equipment

**Table 2: Age Group wise Distribution of Subjects.**

Age Group	Number of Subjects	Percentage
0y-09y	4	4
10y-19y	12	12
20y-29y	37	37
30y-39y	26	26
40y-49y	11	11
50y-59y	6	6
60y-69y	3	3
70y- 89y	1	1
Total	100	100

In the present study of 100 electrocution-related deaths, the majority of victims belonged to the **young and middle-aged groups**. The highest incidence was observed in the **20–29 years age group (37%)**, followed by **30–39 years (26%)**, together accounting for over 60% of cases. This reflects the greater occupational and outdoor exposure of individuals in their most productive years, particularly in construction, agriculture, and electrical work. Adolescents (10–19 years) also formed a notable group (12%), likely due to unsafe handling of electrical devices and lack of awareness. Children (0–9 years, 4%) and elderly individuals above 60 years (4%) were least affected, usually due to accidental contact in domestic environments.

**Table 3: Domicile wise Distribution of Subjects.**

Domicile	No. Of Subjects	Percentage
Rural	55	55 %
Urban	45	45 %
Total	100	100.00

Out of 100 electrocution-related deaths, **55% occurred in rural areas** and **45% in urban areas**. The slightly higher rural predominance may be due to unsafe electrical connections, unprotected wiring, use of substandard appliances, and lack of awareness regarding safety measures in villages.

**Table 4: Religion wise Distribution of Subjects.**

Religion	No. Of Subjects	Percentage
Hindu	82	82 %
Muslim	16	16 %
Sikh	02	02%
Total	100	100.00

Among the 100 electrocution-related deaths, the majority of victims were **Hindus (82%)**, followed by **Muslims (16%)** and **Sikhs (2%)**. This distribution largely reflects the **religious composition of the regional population**, where Hindus are the predominant community. The higher proportion of Hindu victims is therefore not indicative of religion-specific vulnerability but rather corresponds to demographic prevalence and occupational exposure patterns.

**Table 5: Distribution of Subjects According to Site of Electric Injury**

Site Of Electric Injury	Number of Subjects (n=100)	Percentage
Head	02	02%
Neck	05	05%
Chest	03	03%
Abdomen	12	12%
Lower Limb	77	77%
Upper Limb	62	62%
No injury	8	8%

In the present study, the **lower limbs (77%)** and **upper limbs (62%)** were the most frequently involved sites in electrocution deaths, reflecting the common entry points of electric current during accidental contact, particularly through handling of wires, appliances, or exposure while barefoot. Injuries over the **abdomen (12%)**, **neck (5%)**, **chest (3%)**, and **head (2%)** were less frequent, often associated with direct contact with live wires or high-voltage exposure. Interestingly, in **8% of cases no visible external injury** was detected, emphasizing that electrocution can be fatal even without obvious skin marks.

**Table 6: Distribution of Subjects According to Presence of Wound**

Wound	Number of Subjects	Percentage
Entry & Exit Present	52	52%
Entry Only	37	37%
Exit Only	03	03%
Entry & Exit Absent	08	08%
Total	100	100%

In this study of 100 electrocution-related deaths, **entry and exit wounds were present in 52% of cases**, indicating the complete passage of current through the body. **Entry-only wounds were observed in 37%**, suggesting either death before the current could exit or that the exit mark was too subtle to identify. **Exit-only wounds were rare (3%)**, while in **8% of cases no typical electrical marks** were found.

**Table 7: Distribution of Subjects According to Voltage**

Voltage	Number of Subjects	Percentage
High Voltage	32	32%
Low Voltage	68	68%
Total	100	100%

In the present study, **low-voltage electrocution (68%)** accounted for the majority of deaths, whereas **high-voltage exposure (32%)** was less frequent. Low-voltage accidents are more common in households and workplaces due to faulty wiring, defective appliances, and unsafe handling of electrical equipment.

**Table 8: Distribution of Subjects According to Associated Burn**

Associated Burn	Number of Subjects	Percentage
Flash	15	15%
Flame	48	48%
No Burn	37	37%
Total	100	100%

In the present study, low-voltage electrocution (68%) accounted for the majority of deaths, whereas high-voltage exposure (32%) was less frequent. Low-voltage accidents are more common in households and workplaces due to faulty wiring, defective appliances, and unsafe handling of electrical equipment. High-voltage cases, although fewer, were usually

linked to occupational exposure such as construction work, contact with overhead transmission lines, or industrial accidents, and often produced extensive burns with severe internal injuries.

**Table 9: Distribution of Subjects According to Cause of Death**

Cause of Death	Number of Subjects	Percentage
Coma	02	02%
Electrocution	38	38%
Hemorrhagic	3	3%
Shock - Septicemia	55	55%
Spinal	02	02%
Total	100	100%

In the present study of 100 electrocution-related deaths, the most common cause of death was **septicemia (55%)**, usually resulting from secondary infection of burn injuries sustained during electrocution. **Shock due to electrocution (38%)** formed the next major category, reflecting immediate fatal outcomes from electrical current passing through vital organs. A smaller proportion of deaths were attributed to **hemorrhagic shock (3%)**, mainly in cases with associated trauma and burns. Rarely, **coma (2%)** and **spinal causes (2%)** were observed, indicating neurological involvement.

## DISCUSSION

In the present study of 100 electrocution-related deaths, males accounted for 89% while females comprised only 11%. This striking male predominance has also been reported by Patel JP and Gupta BD (2010) in Gujarat, who observed that 87% of victims were males. Similarly, Aggarwal A et al. (2005) from Delhi reported 90% male victims, and Letha S and Rajan J (2016) in Coimbatore found 85% male predominance. This pattern highlights the occupational vulnerability of men, who are more frequently engaged in construction, agricultural and electrical work. The majority of victims in the present study belonged to the young and middle-aged groups, with the highest incidence in the 20–29 years (37%), followed by 30–39 years (26%). Comparable findings were observed by Prasad CSBR & Rajesh DR (2017) in Ballari, where 63% of deaths occurred in the 20–40 years group. Sharma S, et al. (2023) in Jaipur, also reported a peak incidence among 21–30 years, reflecting that individuals in their most productive years are at highest risk. In our study, 55% of cases were from rural areas, similar to Khan N, et al. (2025) in Bhopal, who observed 58% rural predominance. The higher rural burden may be due to unprotected wiring,

lack of safety measures, and use of substandard electrical equipment. Regarding religion, Hindus formed the majority (82%), followed by Muslims (16%) and Sikhs (2%). This distribution corresponds with regional demographics rather than religion-specific vulnerability, as also noted by Prasad K, et al. (2025) in Jaipur. Injury site analysis revealed that the lower limbs (77%) and upper limbs (62%) were the most commonly affected regions. Similar findings were documented by Sharma S, et al. (2023), who observed limb involvement as the frequent entry point for current. The presence of both entry and exit wounds in 52% of cases in our study aligns with Mesina C & Ibrahim A (2025), who emphasized that complete current passage produces typical paired lesions. However, in 8% of our cases no external mark was detected, supporting earlier reports that fatal electrocution can occur without classical signs. Most deaths in the present study were due to low-voltage exposure (68%), with high-voltage contributing to 32%. Comparable observations were made by Patel JP and Gupta BD (2010), where low-voltage was the predominant cause. High-voltage cases, although fewer, were associated with severe burns and extensive tissue damage, as highlighted by Aggarwal A et al. (2005). Septicemia (55%)

emerged as the leading cause of death in our series, mainly due to secondary infection of burn injuries. This is consistent with Sharma S et al. (2023), who also reported septicemia as a common terminal event. Shock due to electrocution (38%) was the second most frequent cause, reflecting the immediate fatal effect of electrical current, in line with Prasad CSBR & Rajesh DR (2017).

## CONCLUSION

The present study shows that electrocution is an important medico-legal and public health problem, predominantly affecting young adult males, especially those from rural areas engaged in high-risk occupations such as construction, agriculture, and electrical work. Limbs were the most frequent sites of contact, with entry and exit wounds present in over half of the cases, though some deaths occurred without visible external marks. Low-voltage current accounted for most fatalities, and septicemia from burn injuries was the leading cause of death. These findings highlight the need for strict safety measures, awareness programs, and meticulous forensic investigation.

## LIMITATIONS OF STUDY

This study was limited to a single tertiary care center, restricting generalizability. Being retrospective and autopsy-

based, many details such as survival period, treatment history, and exact circumstances were incomplete or dependent on inquest reports, which may introduce bias. Histopathology and toxicology could not be performed in all cases. Seasonal variation, socioeconomic status, and occupational details were not fully analyzed, reducing the ability to explore wider epidemiological patterns. These limitations may have influenced the overall interpretation of findings.

## RECOMMENDATIONS OF STUDY

Electrical safety must be prioritized, particularly in rural areas where faulty wiring and unsafe practices are common. Workplace safety protocols should be strictly enforced with training, protective gear, and compliance monitoring. Public health measures should include insulated wiring, safer electrification systems, and residual current devices. Forensic experts must perform meticulous autopsies, documenting subtle injuries and using histopathology when needed. Larger multicentric studies are recommended to identify seasonal and occupational risks. Collaboration between forensic specialists, engineers, and policymakers is essential to reduce electrocution-related deaths.

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NONE

## CONFLICT OF INTEREST

NIL

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