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Original Research Article

An autopsy study of fatal electrocution

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ABSTRACT

Introduction: Electrical Fatality is not Uncommon in Low voltage and High voltage despite rapid advances in its Transmission and usage. It is essential to understand the Injuries and the manner of Death in all Electric Fatalities.

Aims & Objectives: To Understand the Manner of Death, Pattern of injuries, Site of Injuries and Cause of Death in Fatal Electrocution.

Materials and Methods: All the cases Electrical Fatalities Referred by the Police for Autopsies were Analyzed & Examined.

Results: Electric Fatalities Contributed to 4% of the Autopsies. Major Age Group Affected was 21-40 years in 75% of cases. Males to Females Ratio 14.5:1. Accidental Deaths were the Major Number of Fatalities in 96.8% of cases. Low Voltage Electrical Current contributed to 79% of Fatalities. Right Hand was involved in contact injury in 51.7% of Deaths and in 9.7% of Fatal Electrocution No Contact or Exit Injuries were Present.

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1. Introduction

Electrical Fatality Is not Uncommon, and They Pose a Serious challenge to the forensic Pathologist. Though Improvements in the Safety Measures and Quality of Electrical installations, the Fatality both at the Work Place and House are not Uncommon.¹⁻³ In the recent Time Fatality due to Electricity has Drastically reduced though Not Complete. Electric Fatalities are commonly found both at the Workplace and the House. Low-voltage current (from 60 to 1000 V, usually 220 or 360 V) usually found in the Household Supply whereas, high-voltage (more than 1000 V) current, lightning, and voltaic arc are commonly found in the Commercial and Public Transit Supply. Human body conducts electricity and if any part of the body comes into contact with any unprotected electrical source,

the electricity will flow through the Tissues with little Obstruction often leading to Fatality. The Commonest Signs in Electric Fatalities is the presence of Contact Injury and the Exit injuries, but there are circumstance showing these injuries are absent, however based on the circumstances and Exclusion of other possible cause of death Electrocution Deaths are Confirmed. The severity of the electric injuries and its diversity in appearance, also depends on the amount of electric current and type of electric current. Accidental electrocution forms majority of fatalities however suicidal and homicidal electrocution possibility should also be considered. There are instances where Secondary Injuries are present in Electric Fatalities. Hence, it is always essential to understand the Electrical Fatalities in Totality by analyzing Its Injuries, Internal Damage and Cause of Death. The present study is one such attempt to understand the electrical injuries in fatal electrocution.

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2. Materials and Methods

This Prospective Study was carried out during the period 2013 to 2021. All cases were referred for the Forensic Autopsy from the Local Police Station. The Study was carried out in SSIMS, Bangalore and TOMCH & RC, Bangalore. All details of the Cases entered in the Autopsy Report were Examined and Data thus Collected were Analyzed at the end of the Study. Information furnished from the Police were also considered for Corroboration.

3. Aims & Objectives

1. To study the contact & exit injuries in fatal electrocution.
2. To study the age & sex differences in fatal electrocution.
3. To study the manner of death in fatal electrocution.

4. Results

SEX DISTRIBUTION OF CASES

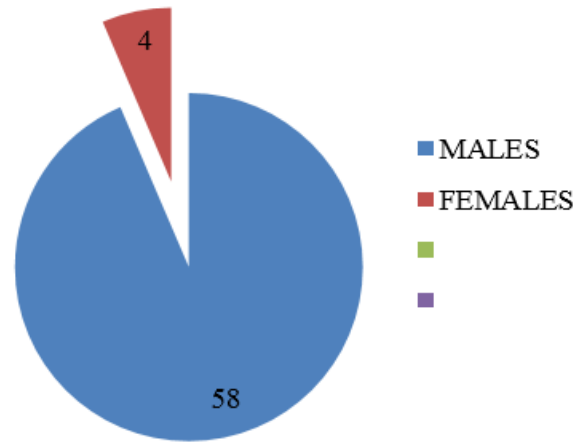


Fig. 2: Sex distribution of cases

Autopsies on fatal electrocution

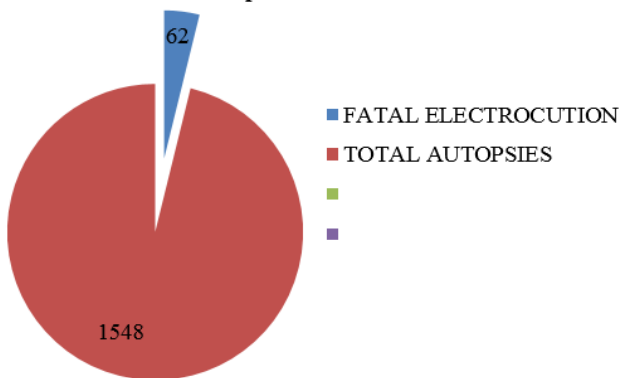


Fig. 1: Total autopsies conducted during the period of study

MANNER OF DEATH

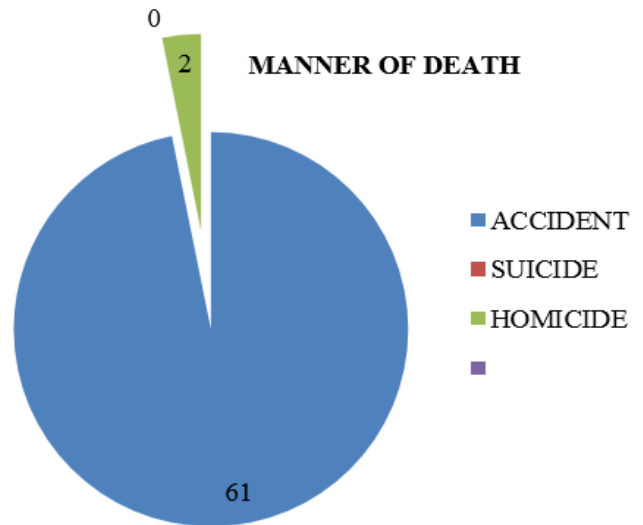


Fig. 3: Manner of electrocution fatalities

Table 1: Low voltage fatalities- place of electrocution

S.No	Place	Total Cases
01	House	38
02	School	02
03	Hostel	02
04	Hospital	01
05	Miscellaneous	06
	Total	49

Table 2: High voltage fatalities -place of electrocution

S.No.	Place	Total Cases
01	Factory	02
02	Farm	02
03	Electric Pole/Transformer	09

ELECTRICAL INJURIES ON THE BODY

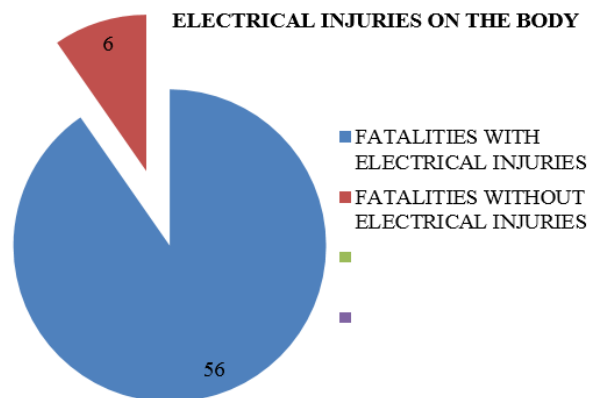


Fig. 4: Electrocution fatalities devoid of contact & exit electric injuries

Table 3: Pathological changes

S.No.	Pathological Changes in Organs	Total number
01	Petechial Haemorrhages in the Cardia	42
02	Pulmonary Haemorrhages	16
03	Myocardial Necrosis	32
04	Burns/Charring	18

Table 4: Age group distribution

S.No.	Age Group	Total No
01	0-10	01
02	11-20	14
03	21-30	31
04	31-40	12
05	41-50	04
06	51-60	00
07	61-70	00

Table 5: Site of electric injury

S.No.	Site	Contact	Exit	Total No
01	Right Hand	Yes	No	32
02	Left Hand	Yes	No	10
03	Right Arm	Yes	No	04
04	Forehead/Head	Yes	No	08
05	Chest Wall	Yes	No	02
06	Right Foot	No	Yes	42
07	Left Foot	No	Yes	12
08	Chest Wall	No	Yes	02
09	Nil	No	No	06

5. Discussion

The Present prospective Study was carried out during the period 2013 to 2021, a total of 62 Electric Fatalities [4%][Fig 01] cases were Autopsied during the Period, these results are in contrast to those observations made in similar studied done by Gupta et al,⁴ Rautji et al⁵ and Gururaj et al⁶ wherein Electric Fatalities contributed to 2.02%, 1.98% & 1.14% respectively. This increase in number of deaths in the present studies is due to Prolonged period of Study [Ten Years] unlike other studies wherein their period of study ranged from 3years-5years. The Other possibility is Urban Factors, Increased Population, Industrial sectors which were major contributors to the Fatalities in the Present study unlike other Similar studies.

In the present study Major number of Victims were Males, 93.5% [n-58] and Females contributed to mere 6.5% [n-4][Figure 2] of the cases, an observations similar to those made by Gururaj et al⁴ and others,⁷⁻⁹ however in a study made by Ivana K et al¹⁰ the Number of Female Victims were 12% of the fatalities, This indicates the Male Dominated Work place at all sectors.

The Major Group affected in the present study were between 21-40 years, 50% [n-31][Table 4] of Fatalities,

followed by those belonging to 2nd and 4th Decade contributing to 22.5% and 19.4% respectively. These observations are close to those made by others.^{4-6,11-13} This increase in Fatalities involving Victims of 2nd and 3rd Decade clearly indicates the Active Age group and Mobility, involved in the Working Class.

In the present Study Majority of the Electrocutation Fatalities were Accidental, 96.8% [n-60][Figure 3] and Homicidal Electrocutation deaths contributed to only 3.2% [n-2] cases and No Suicidal Electrical Fatalities were reported during the period of study, this is similar to the observations made elsewhere.⁴⁻⁶

In a study conducted by Sheikazadi et al¹⁴ & Kuhtic et al¹⁵ Ten cases & 14% of Fatalities were Suicidal Electric Fatalities, which is contrary to the observations made in the present study wherein no Suicidal Electrical Fatalities were reported. This area needs to be closely analyzed as why in his study the choice of the Suicider was Electric Source, Regional Factor or Socio economic Factors cannot be ruled out.

However, the present study is unique in its observations wherein Two cases of Homicidal Electrical Fatalities were reported during the period of Study, in all the Two cases the Victim were Incapacitated by Alcohol and Restrained at the Wrist and Legs, and then the Victims were connected to the Source, as a mode of Killing. These observations had alerted the Investigators the Possibility of Homicides involving Electrical Current.

In the present case Low Voltage Electric Fatalities contributed to 79% [n-49][Table 1], this was close to the observations made by Kuhtic et al¹⁵ wherein Low Voltage Electric current contributed to 75% of Fatalities. The major Fatalities with Low Voltage were recorded in House in 61.3% [n-38] of cases similar were the observations made by Kuhtic et al.¹⁵

In the present Study high Voltage Electrical Fatalities [Table 2] contributed to only 21% [n-13] of the cases.

In the present Study the Major Site of Contact to Electric Source was Right Hand in 51.7% [n-32] cases followed by Left hand in 16.1% [n-10][Table 5] of cases, this is due to the possibility of the Usage of right-handed at the work or Occupation, these observations were similar to those made by other researchers.¹⁶⁻¹⁸ However Right Foot showed the maximum Site for Exit of the Electric Current in 67.7% [n-42] of cases and Head also contributed to Contact source in 12.9% [n-08] of the fatalities. All this indicates that Work at tor around the source of Electrical current without adequate Protective Gears may expose the Body parts to the Source either by touch or Contact, that result i Fatalities. High Voltage Electric Current fatalities always showed gaping contact wounds and Burns involving major part of the body.¹⁶⁻¹⁹

In the present Study the pathological Changes involving the heart showed Hemorrhages and Necrosis of the Muscles

in 67.7% and 51.6% [Table 3] respectively. This indicates that Major route of Transmission is through the Heart.

In 9.7% [n=06] [Figure 4] of Fatalities Contact or Exit Sites could not be Located or Identified, however in a study conducted by Kuhitic et al¹⁵ 50% of his Victims did not showed Contact or Exit Wounds in the Victims, Majority of the victims were either found in the Water Tank, Rain and in Bath Tub.

Hence, In all Death Investigation Involving Electric Current it is essential to Examine the Crime Scene to understand the Circumstances, besides the Type of Electric Current is essential to understand the injuries on the body. Hence, Electric Fatalities always pose a Challenge to the investigators to understand the use of Death and also Manner of Death.

6. Ethical Clearance

The Ethical Clearance was taken from Institutional Ethical Committee, and they had cleared with a comment that it was Postmortem Study and No Clinical Trials was attempted.

7. Conflicts of Interest

The authors have no conflict of interest to declare.

8. Source of Funding

None.

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