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Study of Electrocution Deaths in Chengalpattu During 2020-2022, A Retrospective Study

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Abstract

Background: 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, retrospectively in Chengalpattu region. This retrospective study was conducted in the Department of Forensic Medicine and Toxicology of government Chengalpattu medical college & hospital, Chengalpattu, Tamilnadu, India. Total 3886 autopsies were conducted from January 1, 2020 to December 31, 2022. **Materials and Methods**: All the cases Electrical Fatalities Referred by the Police for Autopsies were Analyzed & Examined. **Results:** Electric Fatalities Contributed to 1.5% of the Autopsies. Major Age Group Affected was 21-40 years in 75% of cases. Males to Females Ratio 8.1:1. Accidental Deaths were the Major Number of Fatalities in 96.6% of cases. Low Voltage Electrical Current contributed to 81.3% of Fatalities. Right Hand was involved in contact injury in 64.4% of Deaths and in 13.5% of Fatal Electrocution No Contact or Exit Injuries were Present.

Keywords: electrocution, accidental, suicidal, current, voltage, electrical fatalities, autopsy.

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Introduction

Electrical Fatality Pose a Serious challenge to the forensic autopsy. 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

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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 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.

Aims And Objectives

To study the prevalence of electrocution deaths in different age, sex, injuries in the body , manner of death , place of death etc. in Chengalpattu region.

Materials And Methods

This retrospective study was conducted in the Department of Forensic Medicine and Toxicology of government Chengalpattu medical college & hospital Chengalpattu, Tamilnadu, India. Total 3886 autopsies were conducted from January 1, 2020 to December 31, 2022, and of them, 59 cases (1.5%) in which death was alleged due to fatal electrocution were selected for this study. All these cases were studied irrespective of their age and gender. Detailed and complete autopsy examination was conducted with the aim to find the area of body parts affected and types of electric injury, whether it is a contact injury or flash burns due to a spark. Information regarding the incidence of electrocution was collected from the police papers, and autopsy reports were taken into consideration to conclude the manner of death, whether it was suicidal and accidental in nature. Finally, the data were collected and analyzed after comparing with those of Indian and foreign authors.

Observations And Results

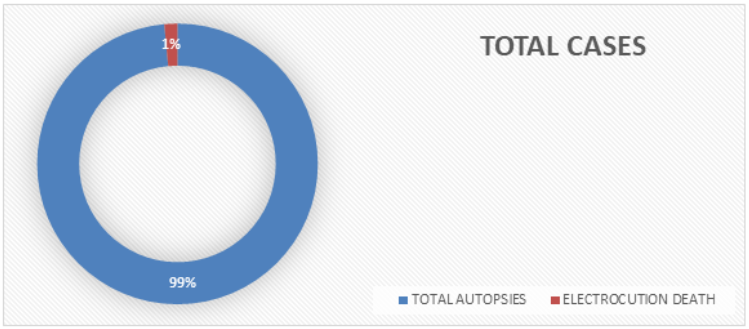

Figure 1: Total autopsies conducted during the period of study

In the present study total number of autopsies done in Chengalpattu medical college over the period of 3 years from 2020 to 2022 is 3886, out of that 59 deaths are due to electrocution.

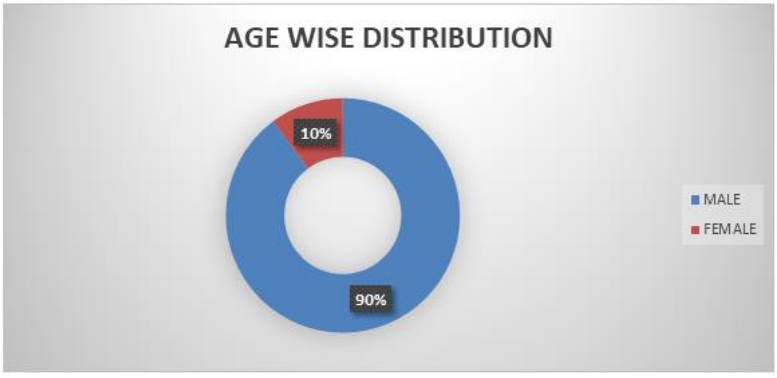

Figure 2: Distribution of Electrocution deaths according to Gender

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From above table observation is made that total 53 (89.8%) males and 6 (10.2%) females died due to electrocution. The male to female ratio was 8.8:1.

Table 1: Distribution of Electrocution cases according to Age

AGE GROUP (IN YEAR)	TOTAL	
	Cases	%
0-10	0	0%
11-20	08	13.6%
21-30	36	61.1%
31-40	13	22.1%
41-50	02	3.4%
51-60	0	0%
>61	0	0%
TOTAL	**59**	**100%**

In the present study maximum numbers of cases were observed in age group 21 - 30, 36 cases (61.1%) followed by 11 - 20 years 13 cases (22.1%). least prevalence was found in the age group of 0-10 and above 51 years, 0 case (0%). 31 - 40, 41 – 50 years, 10 cases (17%) each. Maximum cases are observed in 11 - 30 years age group and are 49 (83.1%).

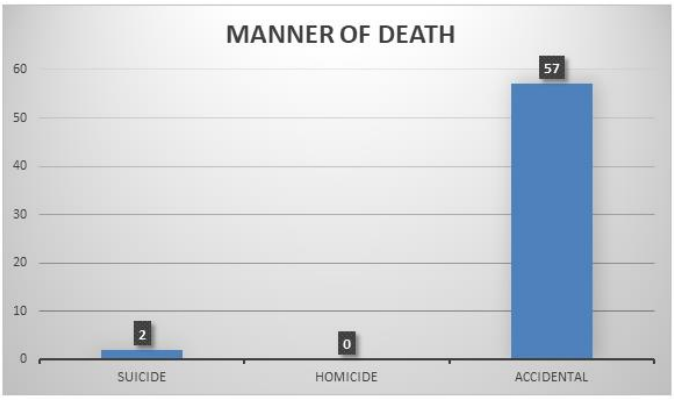

Figure 3: Distribution of Electrocution according to manner of death

In the present study maximum number of Electrocution cases were accidental in nature, 57 cases (97%) and minimum number of electrocution deaths were due to suicide,2 cases (3%). No homicidal electrocution deaths were observed from 2020 to 2022 year.

Table 2: Distribution of Electrocution deaths according to site of injury in the body.

S.NO	SITE OF INJURY	NUMBER OF CASES	PERCENTAGE
1.	RIGHT HAND	38	64.4 %
2.	LEFT HAND	6	10.2 %
3.	RIGHT ARM	5	8.5 %
4.	FORE HEAD	6	10.2 %
5.	CHEST WALL	2	3.4 %
6.	RIGHT FOOT	26	44.1 %
7.	LEFT FOOT	31	52.5 %
8.	NIL	8	13.6 %

In the present study the maximum number of Electrocution cases injury was found in right hand, 38 cases (64.4%) and left foot,31 cases (52.5%), right foot accounts for about 26cases

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(44.1%), left hand and forehead both in 6cases (10.2%), right arm 5 cases (8.5%), chest wall in 2 cases (3.4%). No injuries were found in 8 cases (13.6%).

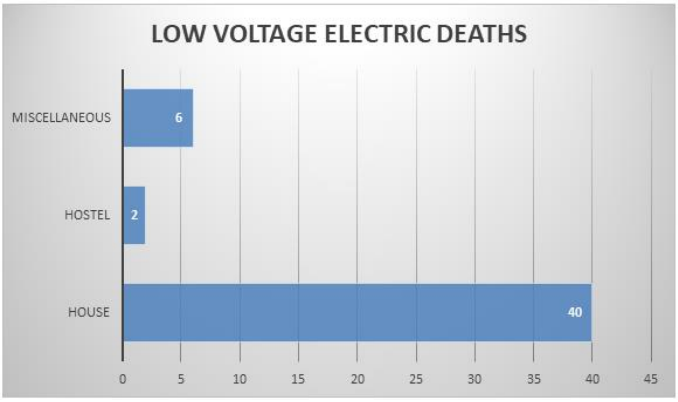

Figure 4: Distribution of Electrocution deaths according to low voltage electricity

In the present study of Electrocution deaths 48(81.4%) deaths out of 59 were due to low voltage electricity. In the 48 deaths maximum number of deaths occurred in household,40 deaths (67.8%), in hostel, 2 deaths (3.4%) and in miscellaneous places, 6 deaths (10.2%).

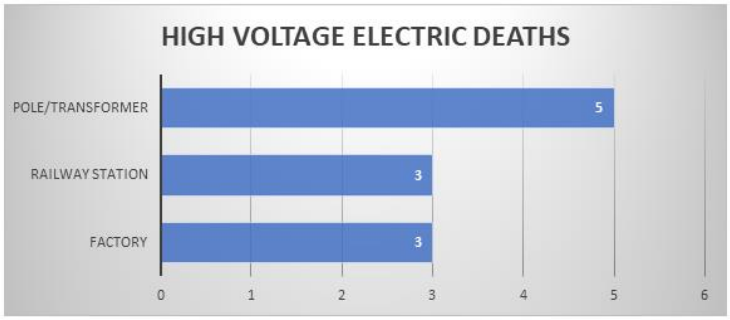

Figure 5: Distribution of Electrocution deaths according to high voltage electricity

In the present study of Electrocution deaths 11(18.6%) deaths out of 59 were due to high voltage electricity. In these 11 deaths maximum number of deaths occurred in electricity pole/ transformer,5 deaths (8.5%), in railway station, 3 deaths (5.1%) and in factories, 3 deaths (5.1%).

Discussion

The Present retrospective Study was carried out during the period 2020 to 2023, a total of 59 Electric Fatalities [1.5%][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 al 5 and Gururaj et al 6 wherein Electric Fatalities contributed to 2.02%,1.98% & 1.14% respectively. In the present study Major number of Victims were Males, 89.9%[n-53] and Females contributed to mere 10.1%[n-6][Figure 2] of the cases, an observations similar to those made by Gururaj et al 4 and others, 7–9 however in a study made by Ivana K et al 10 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, 83%[n-49][Table 1] of Fatalities, followed by those belonging to 3rd and 4th Decade contributing to 61% and 22% respectively. These observations are close to those made by others. 4–6,11–13 This increase in Fatalities involving Victims of 3rd and 4th Decade clearly indicates the Active Age group and Mobility, involved in the Working Class. In the present Study Majority of the Electrocution Fatalities were Accidental, 96.8%[n-57][Figure 3] and no Homicidal Electrocution deaths and 2 Suicidal Electrical Fatalities were reported during the

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period of study, this is similar to the observations made elsewhere. 4–6 In a study conducted by Sheikazadi et al 14 & Kuhtic et al 15 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 Suidee 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 suicidal Electrical Fatalities were reported during the period of Study, in all the Two cases the Victim were died in railway station. In the present case Low Voltage Electric Fatalities contributed to 81.3%[n-48][Fig 4], this was close to the observations made by Kuhtic et al 15 wherein Low Voltage Electric current contributed to 75% of Fatalities. The major Fatalities with Low Voltage were recorded in House in 67.7%[n-40] of cases similar were the observations made by Kuhtic et al. 15 In the present Study high Voltage Electrical Fatalities [Fig 5] contributed to only 18.4%[n-11] of the cases. In the present Study the Major Site of Contact to Electric Source was Right Hand in 64.4%[n-38] cases followed by Left hand in 10.1%[n-6][Table 2] of cases, this is due to the possibility of the Usage of right-handed at the work or Occupation, entry and exit wound, these observations were similar to those made by other researchers. However left Foot showed the maximum Site for Exit of the Electric Current in 52.5%[n31] of cases and Head also contributed to Contact source in 10.1%[n-6] 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. In 13.5%[n-08][Table 2] of Fatalities Contact or Exit Sites could not be Located or Identified, however in a study conducted by Kuhitic et al 15 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 Batch 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.

Conclusion

The passage of electric current through human body can produce multiple effects, varying from a localized muscle spasm to sudden death of the person. All cases of death due to electrocution should be investigated properly for the purpose of compensation and future safety measures. Autopsy in cases of death due to electrocution is not an easy task for the autopsy surgeon because injuries over the body vary from nil to gross destruction of tissues. Majority of the fatal injuries are due to inadvertent contact with a low-voltage domestic supply but these may also occur due to working with a faulty line or in industries or rarely when the people come into the area of magnetic field of a high-tension cable. The mortality rate in cases of fatal electrocution can be decreased by the immediate and adequate resuscitation because often the victim may be in a state of suspended animation. In all these cases, history regarding the incidence with detailed examination of scene of crime and autopsy report may help us to conclude the cause of death and its manner. Study of death due to electrocution be used further to plan and implement the preventive policies to reduce such incidences. Pattern of fatal electrocution injuries in this study is more or less similar to that observed in most of the other studies conducted by various authors. Our study revealed that the most of the victims were men aged between 20 and 40 years who died at home due to accidental contact electrical injury over limbs. This study further clarifies that most of the electrical fatalities are accidental in nature.

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Recommendations

1. Never use a damaged or defective electrical device.
2. Wear protective clothing and equipment and use insulated tools in areas of possible electrical hazards.
3. Child proof your electrical outlets.
4. Don't use extension cords long term.
5. Call an electrician when in doubt.

References

1. Mashreky SR, Rahman A, Khan TF, Svanstrom L, Rahman F. Epidemiology of Childhood electrocution in Bangladesh: findings of national survey. Burns. 2010;36(7):1092–5. doi:10.1016/j.burns.2010.01.008.
2. Accidental deaths and Suicides in India 2011. National Crime Records Bureau. Ministry of Home Affairs. Available at http://ncrb.nic.in/CDADSI2011/ADSI-2011%20REPORT.pdf. Accessed on 24 June 2014.
3. Shaha KK, Joe AE. Electrocution-related mortality: A retrospective review of 118 deaths in Coimbatore. Med Sci Law. 2002;50(2):72–4.
4. Gupta BD, Mehta RA, Trangadia MM. Profile of deaths due to electrocution: a retrospective study. J Indian Acad Forensic Med. 2012;34(1):13–5.
5. Rautji R, Rudra A, Behara C, Dogra TD. Electrocution in South Delhi; A retrospective study. Med Sci Law. 2003;43(4):350–2.
6. Gururaj B, Shetty CK, Babu S, Yogiraj V, Shetty P. Profile of Fatal Electrocution cases in Ballari. Int J Med Toxicol Forensic Med. 2017;7(4):221–6.
7. Fatovich DM. Electrocution in Western Australia, 1976- 1990. Med J Aust. 1992;157(11-12):762–4. doi:10.5694/j.1326- 5377.1992.tb141279.x.
8. Lucas J. Electrical fatalities in Northern Ireland. Ulster Med J. 2009;78(1):37–42.
9. Sheikhazadi A, Kiani M, Ghadyani MH. Electrocution-related mortality: a survey of 295 deaths in Tehran, Iran between. Am J Forensic Med Pathol. 2002;31(1):42–5.
10. Kuhtic I, Bakovic M, Mayer D, Strinovic D. Electrical Mark in Electrocution Deaths - A 20-Years Study. Open Forensic Sci J. 2012;5:23–7.
11. Shrigiriwar M, Bardale R, Dixit PG. Electrocution: a six year study of electrical fatalities. J Indian Acad Forensic Med. 2007;29(2):50–3.
12. Dokov W. Forensic characteristics of suicide by electrocution in Bulgaria. J Forensic Sci. 2009;54(3):669–71.
13. Laupland KB, Kortbeek JB, Findlay C, Kirkpatrick AW, Hameed SM. Population based study of severe trauma due to electrocution in the Calgary Health Region. Canadian J Surg. 1996;48(4):289–92.
14. Sheikhazadi A, Kiani M, Ghadyani MH. Electrocutionrelated mortality: A survey of 295 deaths in Tehran. Am J Forensic Med Pathol. 2006;31(1):42–5.
15. Kuhtic I, Bakovic M, Mayer D, Strinovic D, Petrovecki V. Electrical mark in electrocution deaths - 1 20-years study. Open Forensic Sci J. 2012;(5):23–7. doi:10.2174/1874402801205010023.
16. Karger B, Suggeler O, Brinkmann B. Electrocution-autopsy study with emphasis on electrical petechiae. Forensic Sci Int. 2002;126(3):210–3. doi:10.1016/s0379-0738(02)00061-0.

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 02, 2023

17. Tirasci Y, Goren S, Subasi M, Gruken F. Electrocution related mortality: a review of 123 deaths in Diyarbakir, Turkey between 1996 and 2002. Tohoku J Exp Med. 2006;208(2):141–5. doi:10.1620/tjem.208.141.
18. Byard RW, Hanson KA, Gilbert JD, James RA, Nadeau J, Blackbourne B, et al. Death due to electrocution in childhood and early adolescence. J Paediatr Child Health. 2003;39(1):46–54. doi:10.1046/j.1440- 1754.2003.00070.x.
19. Wright RK. Death or injury caused by electrocution. Clin Lab Med. 1983;3(2):343–53.