# ELECTROCUTION RELATED MORTALITY IN VISAKHAPATNAM- A 15-YEAR RETROSPECTIVE ANALYTICAL STUDY

*Beemsetty Rajesh[1], Rama Krishna Pedada[2], Uppu Rajasekhar[3]*

*[1]Associate Professor, Department of Forensic Medicine, Ponnaiyah Ramajayam Institute of Medical Sciences, Chennai, Tamil Nadu.*
*[2]Assistant Professor, Department of Forensic Medicine and Toxicology, Andhra Medical College / King George Hospital, Visakhapatnam, Andhra Pradesh.*
*[3]Associate Professor, Department of Forensic Medicine and Toxicology, GVPIHD and MT, Visakhapatnam, Andhra Pradesh.*

**ABSTRACT**

**BACKGROUND**

The objective of the study is to analyse and review the electrocution related deaths autopsied at Department of Forensic Medicine & Toxicology, Andhra Medical College mortuary, Visakhapatnam.

**MATERIALS AND METHODS**

This is an analytical study of electrocution related deaths autopsied in the department of Forensic Medicine & Toxicology, Andhra Medical College, Visakhapatnam city from January 2001 to December 2015.

**RESULTS**

A total of 22475 autopsies were done during the period. Three hundred and eighty (380) cases received by the mortuary were deaths due to electrocution. Among them 331 cases were males and 49 cases were females. Majority of victims (55%) were aged 21 to 40 years. 63% of cases of electrocution occurred during daytime. Household fatalities are more accounting for 53%. Majority of cases were due to accidental manner except for 6 cases of suicide. Signs of electric current flow, cause of death and presence of electrical entry/exit wounds also ascertained.

**CONCLUSION**

This study highlights pattern of electrical injuries, signs of electric current flow and variations in incidence of cases of electrocution deaths.

**KEYWORDS**

Electrocution, Victims %, Household, Accidents, Entry/Exit Wounds.

**HOW TO CITE THIS ARTICLE**: Rajesh B, Pedada RK, Rajasekhar U. Electrocution related mortality in Visakhapatnam - a 15-year retrospective analytical study. J. Evid. Based Med. Healthc. 2018; 5(35), 2585-2588. DOI: 10.18410/jebmh/2018/532

## BACKGROUND

Although electrical phenomena have been known and was being studied since time immemorial, it was not until the late nineteenth century that practical applications of electricity were put to use by engineers for industrial and residential purposes. The rapid expansion of electrical technology in 20$^{th}$ century has led to the complete transformation of the industry and society.

Electrical injuries though infrequent are eventually encountered by most emergency medicine practitioners. Electrical injuries encompass various diagnostic and treatment modalities. Generally, they may be classified as lightning, low voltage and high voltage.

*Financial or Other, Competing Interest: None.*
*Submission 10-08-2018, Peer Review 14-08-2018,*
*Acceptance 23-08-2018, Published 27-08-2018.*
*Corresponding Author:*
*Dr. Rama Krishna Pedada,*
*Assistant Professor,*
*Department of Forensic Medicine & Toxicology,*
*Andhra Medical College/King George Hospital,*
*Maharanipeta, Visakhapatnam- 530002,*
*Andhra Pradesh.*
*E-mail: ramkifmt@gmail.com*
*DOI: 10.18410/jebmh/2018/532*

The main effect of electricity is shock produced by its current and the injuries due to electrocution depend on many factors such as voltage and frequency of current, duration of contact with body, atmospheric conditions and route of current in the body.[1]

Electrical injuries have become a more common form of trauma with a unique pathophysiology and with high morbidity and mortality. Almost all fatalities by electrocution are accidental, while homicides and suicides from electricity are rare.[2]

Fatalities caused by electrocution depend on many factors such as individual's characteristics, environmental factors and electric current features, especially the source of electricity.[3]

Though the incidences of death due to electrocution are less, but the cases of injuries are quite common due to accidental touching of live electrical conductor, which is also concluded by most of the authors in their studies in India.

The rising incidences of electrocution injuries has prompted us to undertake this study to know the epidemiological aspects, pattern of injuries and other significant medico legal issues in cases of death due to electrocution and to compare it with the observations of various authors.

Therefore, the objectives of our retrospective study are to characterize the victims of fatal electrocution, investigate the presence of any trend of deaths, to better understand this phenomenon and to ascertain characteristic features aiming to a better identification and prevention of these situations.

## MATERIALS AND METHODS

King George Hospital (KGH)/Andhra Medical College is a tertiary health care center and medical training institute serving population of north costal Andhra districts and adjoining districts of other states. Institute is located close to national highway-15 and is the biggest hospital with around 1500 beds. Medico legal autopsies carried out on requisition from police or magistrate with primary aim to reveal the cause of death (COD) and to decide if COD is in accordance with the postulated manner of death

**Study Design-** A Retrospective analytical Study.
**Study Setting-** Department of Forensic Medicine & Toxicology, Visakhapatnam, Andhra Pradesh.
**Period of Study-** January 2001 to December 2015.
**Sample Size-** All cases of Electrocution death autopsies during the study period i.e. three hundred and eighty (380) cases.

### Inclusion Criteria

Cases that are autopsied with death due to electrocution at King George Hospital Mortuary

### Exclusion Criteria

Deaths due to lightening and hospital admission deaths of electrical burns were excluded from this study.

Sources of information included autopsy registers of department, personal data from inquest forms, histopathology reports and autopsy findings from post-mortem reports.

In order to understand this type of fatalities, deaths due to or related to electrocution were carefully analysed regarding several variables, such as social-demographic ones, circumstances of death, available information and results of medico-legal autopsies.

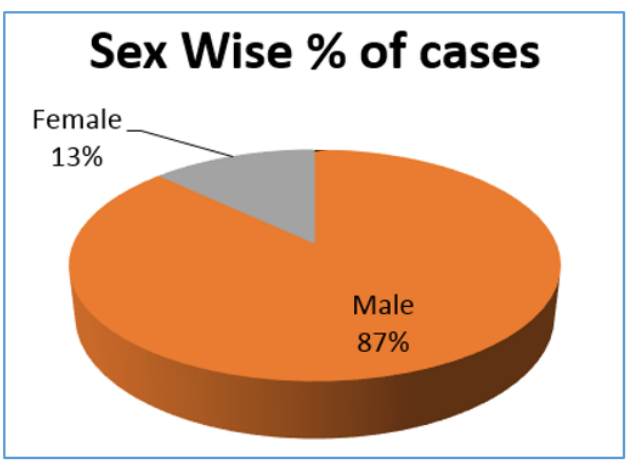
## RESULTS

| Year | No. of Cases (n) |
|---|---|
| 2001 | 1054 |
| 2002 | 1123 |
| 2003 | 1158 |
| 2004 | 1171 |
| 2005 | 1217 |
| 2006 | 1419 |
| 2007 | 1432 |
| 2008 | 1614 |
| 2009 | 1684 |
| 2010 | 1772 |
| 2011 | 1670 |
| 2012 | 1780 |
| 2013 | 1848 |
| 2014 | 1786 |
| 2015 | 1747 |
| **Total** | **22475** |

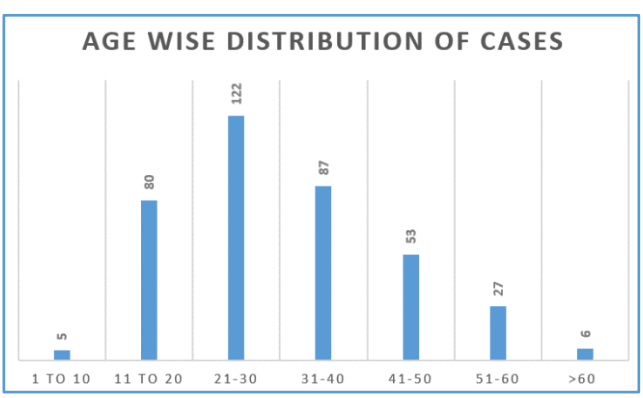
***Table 1. Year Wise Distribution of Autopsy Cases***

| Cause of Death | No. of Cases (n) | Percentage (%) |
|---|---|---|
| Head Injuries | 9017 | 40.12 |
| Burns | 2422 | 10.78 |
| Multiple Injuries | 2364 | 10.52 |
| Poisoning | 2074 | 9.23 |
| Hanging | 1737 | 7.73 |
| Natural deaths | 1660 | 7.39 |
| Drowning | 1052 | 4.68 |
| Blunt Injury Chest/Abdomen | 845 | 3.76 |
| Electrocution | 380 | 1.69 |
| Snake envenomation | 157 | 0.7 |
| Strangulation | 112 | 0.5 |
| Fetal autopsies | 112 | 0.5 |
| Others | 498 | 2.21 |
| Not ascertained | 45 | 0.2 |
| **Total** | **22475** | **100** |

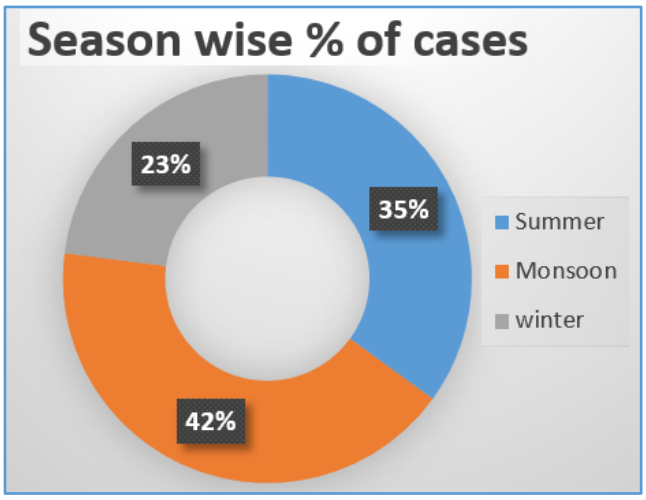
***Table 2. Distribution of Total Autopsies Based on Cause of Death***



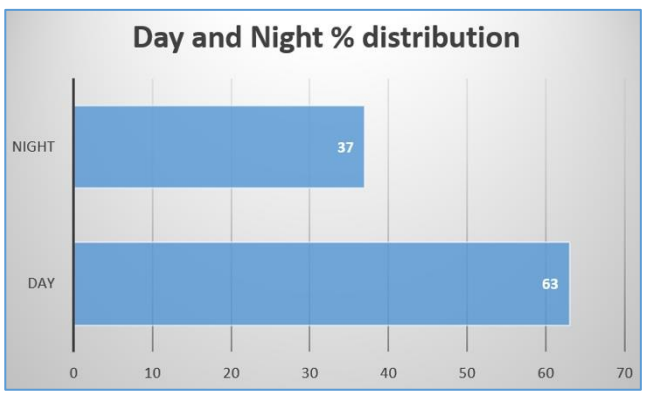

***Pie Diagram 1. Sex Wise Distribution of Cases***



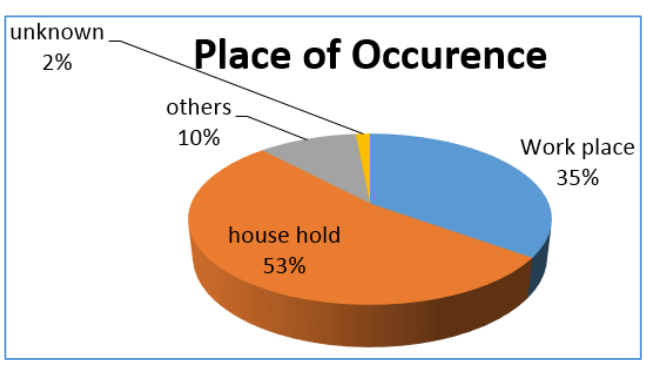

***Bar diagram 1. Age Wise Distribution of Cases***



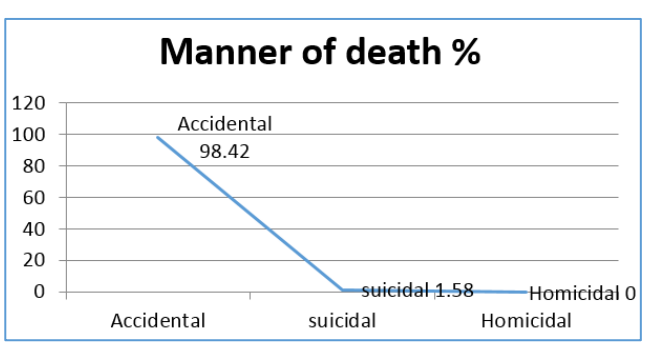

***Pie Diagram 2. Season Wise Distribution of Cases***



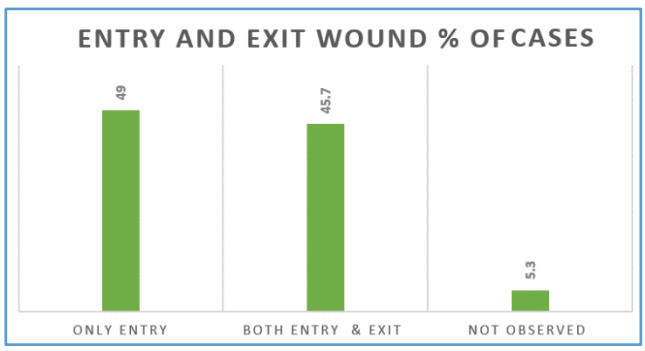

***Bar Diagram 2. Time Wise Distribution of Cases***




***Pie Diagram 3. Place Wise Distribution of Cases***




***Graph 1. Cases Depending on Manner of Death***




***Bar Diagram 3. Distribution of Cases Based on Presence of Entry/Exit Wounds***

| Cause of Death | % | No. of Cases |
|---|---|---|
| Direct electrocution | 89 | 338 |
| Electrocution associated blunt force trauma | 4 | 15 |
| Electrocution associated burns | 7 | 27 |

***Table 3. Distribution of Cases Based on Associated Fatalities***

| Signs of Electric Current Flow | % | No. of Cases |
|---|---|---|
| Focal diaphragmatic haemorrhages | 26 | 99 |
| Petechial haemorrhages | 78 | 296 |
| Congestion | 82 | 312 |
| Oedema | 63 | 240 |

***Table 4. Presentation of Cases Based on Signs of Electric Current Flow Through the Body***

**DISCUSSION**

During the 15-year study period a total of 22475 cases were reported of which 380 cases were deaths due to electrocution. There was, however, a progressive rise in rate of autopsies from 2001 to 2015. Electrocution cases accounted for 1.69% of total autopsies which is little less than observations by Gupta et al.[4] (2.02%) and Rautji et al[5] (1.98%). (Table 1 & 2)

Overall, the findings of this study are in accordance with other similar studies.

Majority of the victims are males accounting for 87% (n=331 cases) and females representing 13% (n=49 cases). (Pie diagram-1)

As evident form Bar diagram-1, 21-30 years age group are more prone for electrical fatalities amounting for 32% (n=122) followed by 31-40, 11-20, 41-50, 51-60 contributing 23%, 21%, 14% and 7% respectively. There were 5 cases below the age of 10 years and 6 cases above age of 60 years. These statistics suggest that people were taking up electricity as profession in particular and employment at an early age generally coupled with the over enthusiasm of youth had amounted for this increase in the incidence of deaths due to this particular form of energy. Age group outcome is consistent with Indian studies[4,5] and also with other country studies.[6,7]

Seasonal variation in electrical fatalities also observed with 42% (n=160) in monsoon followed by summer, 35% and winter 23%. (Pie diagram-2). Seasonal variation in the number of deaths due to electrocution enables us to figure out that more number of cases were reported during the Summer and Monsoon season owing to the increase in use of electricity and electrical appliances in Summer and wet and conducive conditions that prevail in the Rainy season, that conclusively proves that Summer and Rainy season encounter more electricity related accidents.

Household fatalities dominated with 53% followed by work place with 35%. (Pie diagram-3). Previously work place fatalities are more than household fatalities but now curve shifted otherwise because of increase in electrical and electronic consumer durables usage.

Majority of deaths are accidental in manner, 6 cases of suicides were reported and there was no case of homicidal manner similar with Sachil kumar et al. study.[8] (Graph-1)

Both entry and exit wounds were present in 45.7% (n=174) of cases. Only entry wound without any exit wound was present in 49% (n=186) of cases. In 5.3% of cases there was neither typical entry nor exit wound, which is similar with Tirasci et al. study[9]. (Bar diagram-3)

Cause of death was determined as electrocution in 89% of cases and associated blunt trauma was seen in 4% of cases. (Table-3)

Signs of electric current flow in the body were ascertained as depicted in Table-4. Generalized or organ congestion was seen in 82% of cases and generalized or organ oedema was seen in 63% of cases. Petechial haemorrhages were seen in 78% of cases. Focal diaphragmatic haemorrhages observed in 26% of cases. These percentages are corresponding with foreign studies.[10,11,12]

## CONCLUSION

A total of 22475 autopsies were done during the period. Three hundred and eighty (380) cases received by the mortuary were deaths due to electrocution. Among them 331 cases were males and 49 cases were females. Majority of victims (55%) were aged 21 to 40 years. 63% of cases of electrocution occurred during daytime. Household fatalities are more accounting for 53%. Majority of cases were due to accidental manner.

In 5.3% of cases there were no entry or exit wounds, in all such cases, history regarding the incidence with detailed examination of scene of crime and autopsy report may conclude the cause of death and its manner.

The current results point out the importance of a more extensive research concerning the signs of electric current flow through the body like focal diaphragmatic haemorrhages, petechial haemorrhages, congestion and oedema which help in concluding cause of death in absence of entry or exit wounds.

## REFERENCES

[1] Modi JP. A textbook of medical jurisprudence and toxicology. 24th edn. Nagpur, India: Lexis Nexis Butterworths Wadhwa 2012:494-496.
[2] Shaha KK, Joe AE. Electrocution-related mortality: a retrospective review of 118 deaths in Coimbatore, India, between January 2002 and December 2006. Med Sci Law 2010;50(2):72-74.
[3] Gisbert C. Medicina legal y toxicologia. Barcelona: Masson 2004.
[4] Gupta BD, Mehta RA, Trangadia MM. Profile of deaths due to electrocution: a retrospective study. J Indian Acad Forensic Med 2012;34(1):13-15.
[5] Rautji R, Rudra A, Behra C, et al. Electrocution in south Delhi: a retrospective study. Med Sci Law 2003;43(4):350-352.
[6] Dokov W. Forensic characteristics of suicide by electrocution in Bulgaria. J Forensic Sci 2009;54(3):669-671.
[7] Laupland KB, Kortbeek JB, Findlay C, et al. Population-based study of severe trauma due to electrocution in the Calgary Health Region, 1996-2002. Can J Surg 2005;48(4):289-292.
[8] Kumar S, Verma AK, Singh US. Electrocution-related mortality in northern India – a 5-year retrospective study. Egyptian Journal of Forensic Sciences 2014;4(1):1-6.
[9] Tirasci Y, Goren S, Subasi M, et al. Electrocution-related mortality: a review of 123 deaths in Diyarbakir, Turkey between 1996 and 2002. Tohoku J Exp Med 2006;208(2):141-145.
[10] Wick R, Gilbert JD, Simpson E, et al. Fatal electrocution in adults--a 30-year study. Med Sci Law 2006;46(2):166-172.
[11] Anders S, Matschke J, Tsokos M. Internal current marks in a case of suicide by electrocution. Am J Forensic Med Pathol 2001;22(4):370-373.
[12] Karger B, Süggeler O, Brinkmann B. Electrocution--autopsy study with emphasis on electrical petechiae. Forensic Sci Int 2002;126(3):210-213.