

Research Paper: Profile of Fatal Electrocution Cases in Ballari, Karnataka, India

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ABSTRACT

Background: Death by electrocution may not be a major cause of unnatural deaths, but still accounts for a sizeable number of deaths around the world. It is usually accidental in manner. In a developing country like India, electrocution continues to be a significant cause of unnatural deaths. This study was designed to identify the trends and characteristics of electrocution deaths in Ballari region of South India.

Methods: The relevant data were obtained from the Department of Forensic Medicine and Toxicology, Vijayanagar Institute of Medical Sciences (V.I.M.S), Ballari, Karnataka, India from 2010 through 2016.

Results: Based on our study, males aged from 21 to 30 years were the most victims of fatal electrocution. These deaths were highest during the months of September to December and commonly occurred during the day time. The limbs were the most commonly effected body parts. Most cases were accidental in nature while contact with the electric pole being the main source of those accidents.

Conclusion: The study may help enhance public awareness of electrocution deaths. It will also help the enforcement agencies implement strategies to avert such unnatural deaths.

1. Introduction

Electricity is everywhere in the modern world, and exists wherever we work, live or play and has become an important part of our day to day activities [1]. The first case of electrical fatality with

Alternating Current (AC) of 250 volts was recorded in France in 1879 [2]. Interestingly, electricity is not a human invention, as it is observed in nature in the form of lightning [3]. 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

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leading to fatal outcome [4]. Majority of the electrocution deaths are accidental, which can be avoided with simple safety measures [5]. India uses 220–240 V, 50 Hz alternating current [1, 2].

It is often wrongly assumed that a 10000 volts shock would be more deadly than 100 volts shock. There is also a misconception that normal household current and power lines are not lethal since they are insulated [6]. However, electrocution deaths have reported in households using 110 volts currents and in factory workers using as little as 42 volts direct current [6]. Hence, it is the amount of current (amperes) forced through the body, and not the voltage which causes electrocution [7]. Electrocutions may result from a source which is usually considered as nonlethal such as an faulty overhead power line or an open socket [8, 9]. Hopefully the findings of our study may help the concerned authorities implement some safety measures to prevent electrocution deaths.

2. Materials and Methods

Of 5590 autopsies conducted in the Department of Forensic Medicine and Toxicology of Vijayanagara Institute of Medical Sciences, Karnataka, India from the January 1st, 2010 to January 1st, 2016, 64(1.14%) cases were alleged due to fatal electrocution. Relevant data on electrocution deaths were collected retrospectively from the police inquest and the autopsy reports. Finally, the obtained data were tabulated and analyzed.

Data analysis

Data analysis was performed by SPSS (version 22), and results were presented as frequency and percentage in figures and tables.

Ethics

Confidentiality of patients' information was maintained when the data were obtained from the medical records. All guidelines of the Declaration of Helsinki were observed in all study stages. Ethical approval was obtained from the University Ethics Committee.

3. Results

We analyzed 64 cases of fatal electric injuries, which were brought to us for the autopsy examination from January 1st, 2010 to January 1st, 2016. Majority of the victims were men (90.62%), with a male: female ratio of 9.6:1 (Figure 1). Most of the victims (39.00%) were in the third decade of their life, 23(35.93%) cases were found in second decade, 8(12.5%) cases belonged to age group 31-40 years, 3(4.68%) cases were in age group of 41-50 years, 2(3.12%) cases belonged to age group of 71-80 years. Age groups of 1-10 years, 51-60 years and 61-70 years (1.56%) each took one case. Around three-fourths of victims belonged to younger and adult age groups (e.g. from 11 to 30 years) (Figure 2).

With respect to the presentation of fatal electrocution cases according to the diurnal and seasonal variations, most cases (41 cases: 64.06%) were reported during the daytime between 7 am and 7 pm (Figure 4), also the incidences of death were typically higher (38 cases: 59.37%) in the rainy season followed by 15(23.43%) cases in summer (Figure 3). In most incidents, victims were injured by electrocution when they were at home (64.06%) and working with some electric sources.

In our study, the majority of the victims (40%) were brought dead to casualty department. Flame burns due to spark of current accounted for 65% of the cases. Burning of clothes were noticed in all cases of flame burns. Upper limbs were the most common body parts affected by

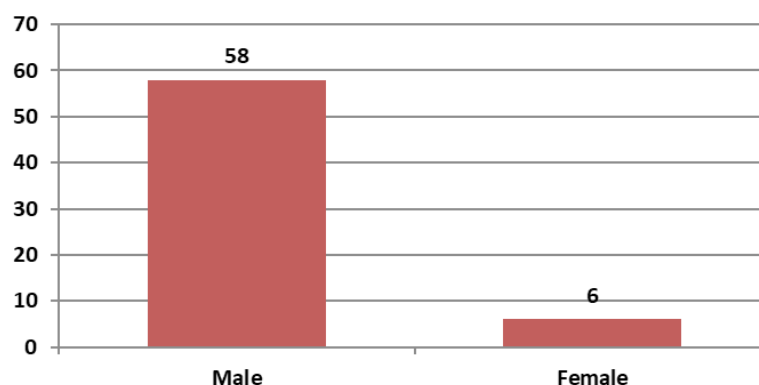


Figure 1. Gender of the victims

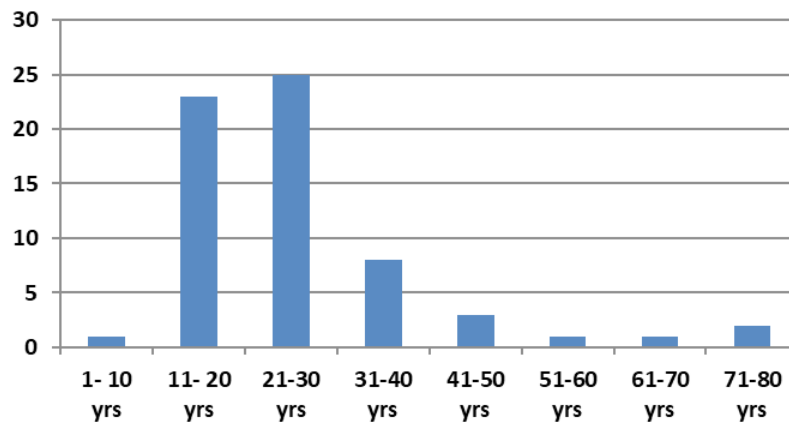


Figure 2. Age wise distribution

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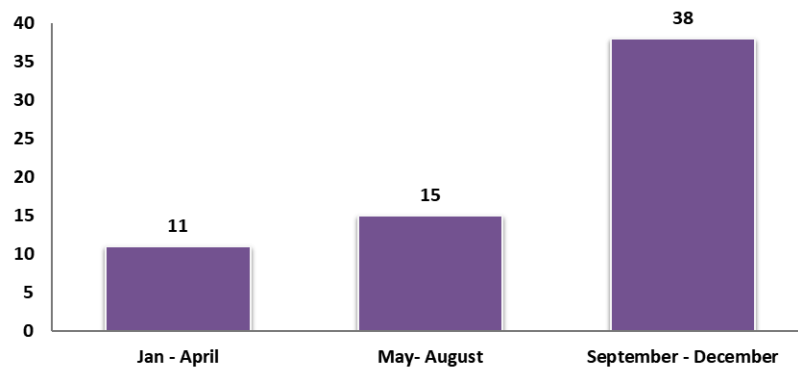


Figure 3. Month wise distribution

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electrocution in 48(75%) of the cases (Figure 5). Contact wound of electrocution were seen in 51.2% of the cases. Interesting to note that the manner of death was accidental in 64 cases (100%) (Figure 6).

In our study, 30 cases (46.87%) were due to contact with electric pole, followed by 20 cases (31.25%) due to contact with live wire, followed by 9 cases (14.06%)

due to domestic appliances and lastly 5 cases (7.81%) due to unknown sources (Figure 7).

4. Discussion

In our study, details such as the age, gender, place of incidence, seasonal variation, entry mark and manner of death were recorded in all cases of fatal electrocu-

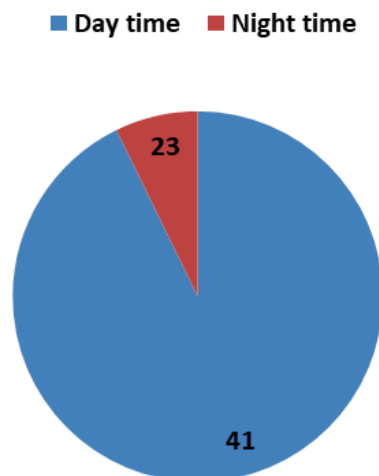


Figure 4. Diurnal variation

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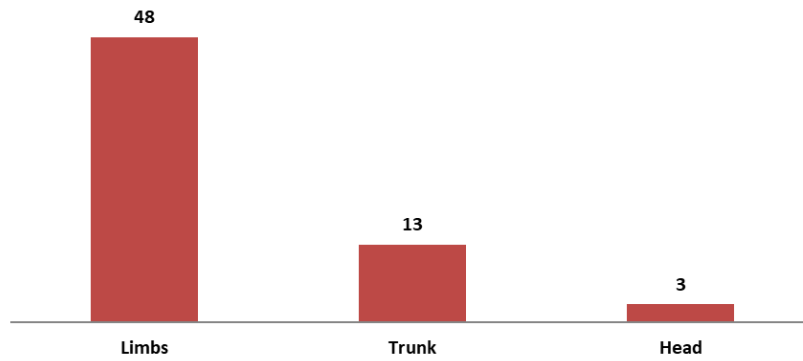


Figure 5. Site of body involved in electric injuries

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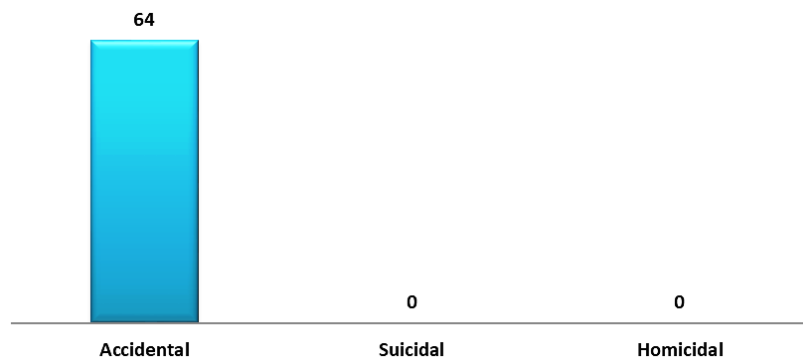


Figure 6. Manner of death

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tion. These findings were tabulated and then compared with similar studies conducted around the world. According to the studies done in India, electrocution deaths are mainly caused by contact with low voltage domestic supply, but the fatalities due to contact with high voltage supply has been lately on the rise.

In our study, the incidence of fatal electrocution was 1.14%, which was close to Gupta et al. [4] (2.02%) and Rautji et al. [6] (1.98%) study results done in India. However the incidence was quite high when compared to the

studies conducted in the developed countries [7, 8]. In our study, majority of the victims were men (90.62%) aged between 11 and 30 years (87.5%), which is consistent with the findings of most other authors [5–9]. Regarding the seasonal and diurnal variations, higher incidences were recorded in the rainy season and majority of the incidents (64.06%) happened during the daytime, which is consistent with the observations made by Gupta et al. [4] and Kumar et al. [10]; however, Shaha and Joe [11] and Sheikhasadi et al. [12] found higher incidences in summer season.

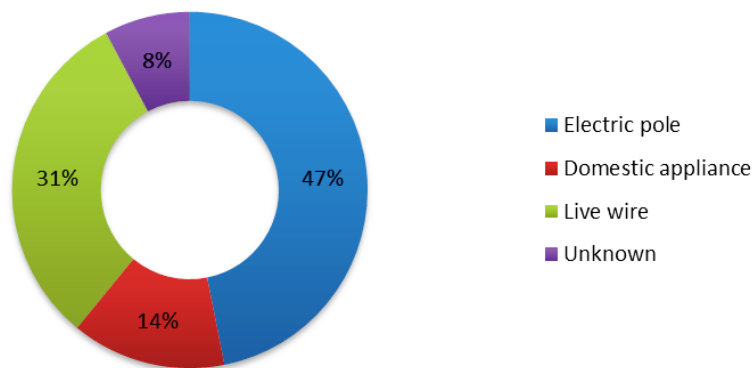


Figure 7. Source of electric current

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In our study electric poles (47%) were the main source of electrocution with upper limbs being the most commonly affected body part, which agrees with the studies done by Kumar et al. [9] and Sheikhasadi et al. [12], but contrary to the observations made by some authors in their studies [5, 6, 10]. In our study, the manner of death in all reported cases of fatal electrocution was accidental which is similar to the other studies. However, Gupta et al. [5] found one case of suicide, and Sheikhasadi et al. [12] reported 10 cases of suicidal electrocution.

Strength of our study lies in the fact that the sample size is quite large while newer parameters such as seasonal and diurnal variations have also been taken into account. Interestingly no such study has been conducted so far in and around Ballari area, South India on this particular subject.

Study Limitations: The main study limitations included its cross-sectional nature and the possibility of self-report biases.

5. Conclusion

In our study, males aged between 11 and 30 years were the most common victims. All reported cases of electrocution were accidental and occurred at day time in the rainy season. Upper limbs were the most commonly affected body parts.

In conclusion, death due to electrocution should be investigated properly for the purpose of compensation and future safety measures, but autopsy diagnosis of electrocution as a cause of death is a great challenge for the autopsy surgeon, since only 50% to 60% of the cases have definitive entry and exit marks; in some case the suspected marks have to be confirmed by histochemical methods or by electron microscopy. In some cases, the examination of the scene, clothing, shoes, gloves and headgear gives us some information. Hence in all cases of suspected electrocution, detailed examination of crime scene and autopsy may help us determine the manner and cause of death. The data can be used further to plan and implement the preventive policies to reduce such incidents.

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Conflict of Interest

The authors declared no conflicts of interest.

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