Demographic profile and pattern of injuries in autopsied fatal electrocution cases in Union territory of India

Ananda Reddy¹, Balaraman R.², Kagne R. N.³

¹Assistant Professor, ³Professor and HOD, Department of Forensic Medicine, Sri Manakula Vinayagar Medical College, Puducherry, INDIA. ²Head, Department of Forensic Medicine, Indira Gandhi Government General Hospital and Post-graduate Institute, Puducherry, INDIA.

Email: fmreddy2@gmail.com

Abstract

Background and Objectives: This autopsy based cross-sectional study of fatal Electrocuton cases in the union territory (Puducherry) are aimed to evaluate socio-demographic profile and pattern of electrical and other associated bodily injuries in such cases. Materials and Methods: All 23 fatal electrocution cases autopsied at the Indira Gandhi Government General Hospital and Postgraduate Institute (IGGGH and PGI), Puducherry during calendar year 2012 was analyzed. Observations and Results: Fatal electrocution cases were accounted for 1.47% (23) of all medicolegal autopsies (n=1560) done in that year at our study centre. Predominantly male gender and adults in the age group of 21-40 years (48%) are the victims. The demographic profile of studied victims revealed that the majority of them were belonged to rural area (65%), literates (61%), Hindu religion (83%), Married (57%) and middle income group (52%). Occupationally most of them are agricultural workers (26%), Labourers (22%) and housewives (17%). Upper extremity parts like hands and fingers (70%) are the most commonly affected body parts, next is lower extremity parts like soles and toes (17%). The entry wound alone was found in 11(48%) cases, both entry and exit wounds were found 7(30%) cases, whereas only exit wound was found in 3(13%) cases and no electrical marks in 2 (09%) cases. All deaths are accidental, no suicidal and a homicide case was reported. Chemical analysis and histological investigations were useful to diagnose in few cases. Conclusions: Despite safety precautions, domestic and occupational hazards are occurring due to electrocution. It is important to develop proper strategies for prevention of electrocution and to decrease rates of electrocution fatalities.

Keywords: Electrocuton, Electrical injuries, Entry and Exit wounds, Safety precautions.

INTRODUCTION

Injuries from electricity have been reported for almost 300 years. Electricity is essential to modern life and is extensively used in domestic, industrial and at various work places nowadays; and simultaneously the incidence of electrocution is also increasing in these places. Electrical injuries are responsible for a considerable proportion of morbidity and mortality and they are preventable with simple safety measures. Electrocuton injuries are among the top ten occupational killers in India and are slowly evolving into a public health problem. Literally almost all electrocution fatalities are accidental, but very rarely few incidences are suicidal or homicidal in nature. Lack of public awareness, Carelessness, misuse or improper maintenance of electric equipments are responsible for electrocution worldwide.

According to the data on incidence and rate of accidental deaths in India during (2002-2012), electrocution alone have contributed for 8945 and 8750 deaths in 2011 and 2012 respectively, and they constitute 2.2% of total accidental deaths. Puducherry, the capital of the union territory located in south India has reported the highest
rate of accidental deaths (80.1 deaths per lakh population) as compared to the national average of 32.6. The present study is aimed at highlighting the demographic profile, pattern of injuries to the deceased in fatal electrocution cases and also the importance of accessory investigations to rule the cause of death in electrocution cases.

MATERIALS AND METHODS
This autopsy based cross-sectional study was conducted in the mortuary complex of Indira Gandhi Government General Hospital and Postgraduate Institute (IGGGH and PGI) in Puducherry. This study was conducted with clearance from the institutional research and ethical committees and permission from a medical record section of IGGGH and PGI. Each deceased when reported to be died due to electrocution, the demographic profile information was gathered and entered into the data sheet after an interview with the relatives, investigating officer and by going through reports prepared by investigating officer. The data related to autopsy findings including external injuries and internal findings were recorded after meticulous post-mortem examination. The samples collected from the cadavers for investigation like histopathological, chemical analysis and the final opinion will be recorded and analyzed. Statistical methods used for analysis are frequencies, Percentages, and proportions. Tables, bar charts and line diagrams were used appropriately for interpreting results.

OBSERVATION AND RESULTS
Among the 1560 medico-legal autopsies conducted in the study center during the calendar year 2012, 23 cases were reported to be due to the fatalities of electrocution. Hence electrocution fatalities were contributed to 1.47% of all medico legal autopsies in 2012. The male gender affects more than females (5:1). The majority of the victims were in the age group of 21-40 years (46%). Gender and age distribution of cases were shown in Table 1 and Demographic profile data is shown in Table 2.

Highest numbers of cases were occurred in the month of April, July and August (Figure 1). Most of the victims are agriculture workers and farmers (26%), next to that is labourer (22%), housewives (17%) and students (09%) (Figure 2). Investigative findings suggest that Domestic appliances are responsible for 70% cases, followed by industry (13%), electric wires (9%) and high tension wire (04%) (Figure 3). All the cases were due to accidents except in one unknown case we could not able to determine the manner of death, but no suicidal and homicidal deaths.

Table 1: Gender and Age distribution of cases

<table>
<thead>
<tr>
<th>Age group (in years)</th>
<th>Number of cases and Percentage</th>
<th>Male gender</th>
<th>Female gender</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10</td>
<td>02 (09%)</td>
<td>02 (09%)</td>
<td>00 (00%)</td>
</tr>
<tr>
<td>11-20</td>
<td>03 (13%)</td>
<td>03 (13%)</td>
<td>00 (00%)</td>
</tr>
<tr>
<td>21-30</td>
<td>06 (26%)</td>
<td>05 (22%)</td>
<td>01 (04%)</td>
</tr>
<tr>
<td>31-40</td>
<td>05 (22%)</td>
<td>03 (13%)</td>
<td>02 (09%)</td>
</tr>
<tr>
<td>41-50</td>
<td>04 (17%)</td>
<td>04 (17%)</td>
<td>00 (00%)</td>
</tr>
<tr>
<td>51-60</td>
<td>02 (09%)</td>
<td>02 (09%)</td>
<td>00 (00%)</td>
</tr>
<tr>
<td>&gt;60</td>
<td>01 (04%)</td>
<td>00 (00%)</td>
<td>01 (04%)</td>
</tr>
<tr>
<td>Total</td>
<td>23 (100%)</td>
<td>19 (83%)</td>
<td>04 (17%)</td>
</tr>
</tbody>
</table>
Majority of the accidents were occurred between 6AM to 12noon (39%) and between 3PM to 9PM (35%). Out of 23 fatal cases, 6 (26%) were hospital deaths and rests of them are non-hospitalized, because they were found dead at the scene of crime (70%). The commonest location of entry and exit wounds is over hands and fingers (70%) of upper extremity and soles and toes (17%) of lower extremity respectively (Table 3).

### Table 3: Type and location of electrical injuries observed over the body at autopsy

<table>
<thead>
<tr>
<th>Type of electrical injury</th>
<th>Number of cases</th>
<th>Percentage</th>
<th>Location of electrical injury</th>
<th>Number of cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entry wound alone</td>
<td>11</td>
<td>48%</td>
<td>Hand and Fingers (Upper extremity)</td>
<td>16</td>
<td>70%</td>
</tr>
<tr>
<td>Exit wound alone</td>
<td>03</td>
<td>13%</td>
<td>Sole and toes (Lower Extremity)</td>
<td>04</td>
<td>17%</td>
</tr>
<tr>
<td>Entry and Exit wounds</td>
<td>07</td>
<td>30%</td>
<td>Head and Neck</td>
<td>01</td>
<td>04%</td>
</tr>
<tr>
<td>No entry or Exit wounds</td>
<td>02</td>
<td>09%</td>
<td>Chest</td>
<td>01</td>
<td>04%</td>
</tr>
<tr>
<td>Burns</td>
<td>03</td>
<td>13%</td>
<td>Abdomen</td>
<td>00</td>
<td>00%</td>
</tr>
<tr>
<td>Other injuries</td>
<td>07</td>
<td>30%</td>
<td>Pelvis</td>
<td>00</td>
<td>00%</td>
</tr>
</tbody>
</table>

Chemical analysis of the viscera was done in 15 cases and it was found to positive for alcohol in only 3 (13%) cases. Histopathological examination of the skin from the electrical injury site showed positive for electrical burns in 9 (67%) of 15 cases.

**DETERMINATION OF STATURE FROM BONES**

Electrocution is an uncommon cause of death and occurs commonly due to an accident. Overall, the incidence of electrocution deaths were 1.47% of all the autopsied cases in that academic year. The studies done in other part of our country and also abroad have reported varying incidence of electrocution deaths from 1.9 to 3.3%. The findings of our study could not be compared with the other studies because of the difference in public awareness on electrical hazards and safety measures, frequency of using electric appliances at occupations, education status of the population and non-uniformity of weather. In the present study deaths of males outnumbered females (5:1). Studies conducted in different parts of India like Coimbatore, South Delhi, Jamnagar, on electrocution deaths also showed a male preponderance, the reason being males exposed to electrical works more often in industry and domestic places than females. Young adults between 21-40 years (48%) area vulnerable population for electrocution and found rare in extremes of ages. Similarly majority of the victims were in the age group of 21-40 years and 20-50 years. The significant number of electrocution accidents were occurred between 9AM to 12noon (39%) and between 3PM to 9PM (30%) in our study. Which is consistent with the timing of electrocution in other researcher works. The heavy usage of domestic appliances and industrial machines during these hours are notable reasons. More electrocution deaths were occurred during summer and early monsoon seasons of this territory that is in the months of April, July and August. These findings are consistent with the South Delhi study (monsoon) in India and Tirasci study in Turkey (summer). The reasons may be due to increased humidity, wet moisture, water logging and be havioral factors. The study conducted by a researcher in Tehran (Iran) between 2002 to 2006, revealed that 61% of victims were found dead at the scene of crime and rest were died on arrival to the hospital and another study in Manipur observed 80% victims died immediately after electrocution. In our study we found 70% dead at the scene of crime and rest died after admitted to hospital. All the cases reported are accidental in nature except in one case we could not able found out the exact manner of death, but no suicidal or homicidal case was reported in our study. The frequency of suicidal electrocution cases varies from 0.65% to 29%, according to the researchers. Wet cases of
electrocution using bathtubs, heaters and hair dryers were not reported in our study and other Indian studies because usage of these appliances is rare in this part of the country. But such variety of suicidal deaths by immersion in the bathtub was reported in an Australian study. The diagnosis of electrocution was clear in most cases, based on the typical electrical injury marks and joule burns on the body at the site of contact with electric appliance or wire. In the present study, we observed only entry marks in 11(48%), only exit marks in 3 (13%) and presence of both entry and exit wounds in 7(30%) of cases. In contrast to this study other researchers concluded that entry wounds were observed varying from 72% to 86.27%. The most of the electrical entry wounds were located on the upper extremity (hands and Fingers), while exit wounds were commonly located on the lower extremity (Soles and toes) in this study. Similar findings were reported from other studies because most of the times electric appliances will be handled with hands without any insulating measures. In addition to the electrical injuries we noticed burn injuries in 3 (13%) cases, of that one case is due to exposure to high tension wire and in remaining two cases are due to contact with electric pole wire. Chemical analysis of the viscera was done in 15 cases to find out the cause of death in electrocution cases and it was found to positive in 3 (13%) cases for alcohol intoxication. The proof of electrical marks is obtained by histological examination of the skin. Examination of the skin from the electrical injured site showed positive findings for histological changes of electrical burns in 10 (67%) of 15 cases examined. Weaknesses of this study - The sample size is less to make generalization of these study findings to entire south Indian Population. Histopathological examination and chemical analysis was not performed in all cases. There is a need for large scale medico legal investigative studies on electrocution deaths to diagnose the exact cause of death.

**CONCLUSION**

- Male gender and adults between 21-40 years are the predominant victims of electrocution.
- Hindus Married, Literates, Middle Income group and rural people are a vulnerable population according to our study.
- Occurred more frequently in the summer and early monsoon.
- Significant risk of electrocution in agricultural workers, Laborer and housewives,

- Most of the electrocutions were accidental in nature and death occurred at the scene of crime.
- Entry mark sure the commonest type of electrical injury and hands and fingers are common sites for electrical injury.
- Histological examination plays a vital role in diagnosis of electrical injuries in suspected cases.

**SUGGESTION**

- Promote people to follow electrical safety measures in the home, industry and at work places.
- Health education to children and young adults regarding health hazards and safe usage of electrical appliances at home and work places.
- Most of the electrical deaths are preventable by following simple safety precautions.

**ACKNOWLEDGEMENT**

I express my wishes and deep sense of gratitude to all the faculty members of Department of Forensic Medicine, Indira Gandhi Government General Hospital and Post-Graduate Institute (IGGGH and PGI), Puducherry.

**REFERENCES**


Source of Support: None Declared
Conflict of Interest: None Declared