

Study of electrical injuries in fatal cases brought to Gandhi Hospital Mortuary, telangana Sunil Kumar Damera¹, Harikrisna², Amar Singh³

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Received: 08-05-2021 / Revised: 22-06-2021 / Accepted: 16-07-2021

Abstract

Background: Electrocution deaths are mostly accidental in nature. Lack of public awareness, carelessness, misuse or improper maintenance of electric equipment are responsible for electrocution worldwide. **Aim of the study:** To study electrical injuries in fatal cases brought to Gandhi Hospital mortuary. **Materials and Methods:** This was a cross sectional study on fatal cases of electrical injuries which were subjected for postmortem examination at Gandhi Hospital mortuary, Secunderabad, over a period of two years from 1st July 2012 to 31st June 2014. A total number of 10867 postmortem examinations were done from June 2010 to May 2012. **Results:** A total of 10867 postmortem examinations were done from June 2010 to May 2012. The total deaths due to electrical injuries in two years were 75(0.69%). Among the total cases of study population, male deaths were 70(93.3%) and constituted majority of the electrocution deaths where as female deaths were 5 (6.67%). In the present study, 74 cases (98.67%) showed electrocution deaths and only 1 case (1.33%) of electrocution deaths showed association with head injury. **Conclusion:** In our study, human negligence was found to be the major cause of electrical injury. (54.67%). Majorities of fatalities were caused by touching high tension wires (65.33%). Electrocution can be prevented by educating people about the precautions and protective measures while working with electrical equipment. Proper maintenance of electrical equipment can help reduce electrocution deaths.

Keywords: Electrocution, Human negligence, Electrical injuries

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Introduction

The word electric is derived from Greek word "Electron". Natural energy in the form of electricity has been known for the past two thousand years. In earlier days it was a scientific curiosity. Its interest remained with scientists till Alesandro Volta, in 1800, discovered what is known as current electricity. In present times, the above statement made by Edison has come true and electricity has reached house of every common man[1]. 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. Electrocution 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[2]. Lack of public awareness, carelessness, misuse or improper maintenance of electric equipment are responsible for electrocution worldwide. Electricity can be in various forms like lightning, static electricity, electromagnetic induction and electrical current. In addition,

electricity permits the creation and reception of electromagnetic radiation such as radio waves[3].

Aim of the study

To study electrical injuries in fatal cases brought to Gandhi hospital mortuary.

Objectives:

1. To study age and gender distribution.
2. To study the distribution and pattern of injury.
3. To determine the manner of death in electrocution.
4. To suggest concrete preventive measures to make house and work place safer so as to prevent electrocution.
5. To bring awareness among people.

Materials and Methods

The present study was a hospital based cross sectional study made on the cases of Electrical Injuries which were subjected to postmortem examination at Gandhi Hospital Mortuary, Secunderabad, over a two year period from 1st July 2012 to 31st June 2014. Informed written consent was taken from all the next of kin. All the cases of electrocution deaths were considered. There were no ethical issues. Cases which died on the spot, brought dead and while undergoing treatment in hospital were studied. Some of them also occurred during the transport from the spot to hospital. Postmortem examination was conducted as per protocol for all the cases. Some of the postmortem examinations were attended, relevant reports were collected from the departments, inquest report, Panchanama of Scene of Offence was also noted. Information and literature search regarding the present problem was gathered from several books from the department and college library. Journals were referred in National

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Informatics Centre. Some information was also collected from online resources. Photographs were taken in the mortuary during autopsy. All this information was collected on a predesigned proforma, summed up, computerized data sheets were prepared, analyzed, and statistics were prepared under discussed objectives. Tables, graphs and other statistical diagrams were prepared to get information at a glance. At the end, incidence and prevalence of the problem is discussed, in comparison with the present status to the past, also comparisons with other studies, and for information from other countries was done. The preventive measures that are to be undertaken, to reduce the incidence are also highlighted in the study.

Criteria of selection: The dead bodies with cause of death due to electrical injuries.

All age groups from both sexes were selected for this study.

Deaths which occurred without treatment or after the treatment for injuries were included.

Exclusion criteria: Cases other than electrocution such as scald burns, blast deaths, lightning strikes, flame burns were excluded.

Cases from exhumation and spot autopsy were excluded.

Observations and Results

A total of 75 cases of electrical injury deaths were studied over a two year period. A total of 10867 (1st year: 5231 and 2nd year: 5636) postmortem examinations were done of which 75 were due to electrical injuries.

Table 1: Incidence of cases with cause of death as electrical injuries among the total cases in two years study

S.No.	Cause of Death	1 st year of study	2 nd year of study	Total
1	Electrical injuries	38 (0.73%)	37 (0.66%)	75 (0.69%)
2	Without electrical injuries	5193 (99.2%)	5599 (99.34%)	10792 (99.3%)
3	Total deaths	5231 (100%)	5636 (100%)	10867 (100%)

Electrical injuries constituted nearly 0.73% in all autopsies conducted at mortuary, in Gandhi Hospital during the 1st year (July 2012-June 2013) of study and 0.66% during the 2nd year (July 2013-

June 2014) of study showing slight decrease in incidence. The total deaths due to electrical injuries in two years being 75(0.69%)

Table 2: Distribution of Electrocution deaths according to age

Age distribution	No. of cases	Percent (%)
Below 1 year	1	1.33%
1-10 years	3	4%
11-20 years	12	16%
21-30 years	32	42.67%
31-40 years	14	18.67%
41-50 years	6	8%
51-60 years	2	2.67%
60-70 years	5	6.67%
Total	75	100%

Among the total 75 cases, the highest number of cases was recorded in the 21-30 years age group i.e. 32 cases (42.67%), followed by 31-40 years age group which recorded 14 cases (18.67%) and the least number of cases were seen in age below 1 year with 1 case (1.33%).

Gender-wise distribution of cases

Among the total cases of study population, male deaths were 70(93.3%) constituted majority of the electrocution deaths where as female deaths were 5 in number (6.67%) and the male to female ratio was 14:1. In the present study, 74 cases (98.67%) showed pure electrocution deaths and only one case (1.33%) of electrocution death showed association with head injury.

Among the total study population, 72 (96%) cases were identified and 3(4%) cases were not identified.

Comparative studies related to socio-economic status

In the present study, the maximum number of deaths were noticed among lower class i.e. 38 (50.67%) deaths followed by middle class i.e. 30 (40%) deaths and least deaths were seen among the unknown group i.e. 3 (4%) deaths.

Marital status

In the present study, fatalities were seen more among the persons who were married i.e. 44 (58.67%) people were married and 28 (37.33%) were unmarried and status of 3 (4%) cases was not known.

Death according to day of the week

In the present study, more deaths were noted on Saturday i.e. 16 deaths (23.19%). Monday and Tuesday coincidentally showed the same number of deaths with 13 deaths (18.84%) each. Friday showed the least deaths i.e. 1 (1.45%) case.

Death according to time of the day

In this study, most of the deaths were noted during the evening time numbering up to 28 deaths (37.33%) compared with those, which

occurred in morning time i.e. 13 deaths (17.3%). Others were spread across the rest of the hours.

Seasonal variation

The number of deaths in the study population occurred in the Winter month with 28 cases (37.33%) and least in spring season with 7 (9.33%) cases.

Hospital admission

History of hospital admission for the electrical injuries was present in 41 (54.67%) cases whereas 34 (45.33%) cases were not admitted in the hospital.

Comparative studies related to period of survival

In the present study, the number of cases who died on the spot was 53(70.67%).

History of alcohol intake

In this study, 4 (5.33%) cases were found to be under influence of alcohol and 71(94.67%) cases did not exhibit this finding.

Place of death

In the present study, most of the deaths, 31 (41.33%) deaths occurred at their residence, 22 (29.33%) deaths occurred at work place i.e. industrial accidents and 8% deaths occurred in agriculture fields.

Employment

According to this study, 60 (67.01%) cases were employed, and 7 (9.33%) were unemployed. Of these 60 cases who were employed, 8 cases(10.67%) were electricians i.e. professionally related to the study.

Surrounding area

In 59 (78.67%) cases, the surrounding area was dry and in 16 (21.3%) cases it was wet.

Entry and exit wounds:The majority of electrical injuries were distributed with both entry and exit wounds in 52 (53.61%) cases followed by only entry wounds in 6 (8%) cases.

Site of electrical injury contact

In the present study, 60 (80%) cases had electrical injury in upper extremity followed by 9 (12%) cases with lower extremity electrical injury and the remaining had no entry wounds.

Type of electric equipment

Maximum number of cases 49 (65.33%), were caused by high tension wire, followed by 18 (24%) cases with Home appliance, and only 8 (10.67%) cases were caused by faulty water pump.

Human negligence

Human negligence was observed in 41 (54.67%) cases, in 18 (34.67%) cases it was due to faulty equipment and connections, and in 8 (10.67%) cases, it was due to lack of protective measures.

Discussion

In the present study, a total of 75 deaths due to electrical injuries were studied by way of postmortem. The deceased age ranged from less than 1 year to 70 years and the male to female ratio was 14:1.

Comparative studies related to incidence

In the present study, the total deaths due to electrical injuries in two years was 75 with an incidence of 0.69%. Rautji et al[4] and Tirasci et al[5] in their studies reported the incidence to be 1.98% and 3.3% respectively.

Comparative studies related to age distribution

In the present study the highest number of cases were recorded in the 21-30 years age group i.e.32 (42.67%) cases followed by 31-40 years age group which recorded 14 (18.67%) cases which correlates well with the study of electrocution deaths by Bharath et al[6], Gupta et al[7] and Shaha and Joe et al [8]who observed similar findings in different parts of the country. As this corresponds to the age of working class men, more electrical injuries are logical in these age groups.

Comparative studies related to gender distribution

In the present study, the majority of the electrocution deaths are in males. This is in consistency with the work of other researchers [9,10]. As the electrical related work is conventionally carried out by males, these injuries are common in males than females.

Comparative studies related to socio-economic status

In the present study, the maximum number of deaths were noticed among lower class i.e. 38 (50.67%) deaths followed by middle class i.e. 30 (40%) deaths and least deaths were seen among the unknown group i.e. 3 (4%)deaths. Obviously many factors prevalent in this class like illiteracy, lack of awareness about the hazards of electricity, poor maintenance of equipment and wire linings etc. must have been responsible for this difference.

Comparative studies related to marital status

In the present study, fatalities were more among the persons who are married i.e. 44 (58.67%) deathswhen compared with unmarried persons i.e. 28 (37.33%)deaths. This is more to do with the age of the cases as conventionally most would be married by the adult age of 25 years and above in our country. Though insignificant, this aspect was covered in this study.

Comparative studies related to association with other injuries

In the present study, one case showed association with other injuries i.e. with head injury. Other similar non electrocution injuries were found in 19 (18.63%) cases in a study by Gutpa et al[7]

Comparative studies related to day and time of incidence

In the present study more deaths were noted on Saturday i.e. 16 (23.19%) deaths and in the evening time (37.33%). No other study which covered this aspect could be found.

Comparative studies related to seasonal distribution

In the present study, more number of deaths occurred in the Winter season with 28 (37.33%) casesand least in spring season with 7 (9.33%) deaths which is against findings of R.K.Wright and J.H.Davis et al [11]where there was predominance of cases in summer.

Comparative studies related to admission in the hospital

In the present study,the number of cases admitted in the hospital was 41(54.67%) and cases not admitted in the hospital was 34 (45.33%). Other studies could not be found with this variable.

Comparative studies related to period of survival

In the present study, the number of cases which died on the spot were 53(70.67%) were highest. Similar findings were observed in a study by Sheikazadi et al[12] where 60.7% were dead on the scene and 31.9% were dead on arrival at the hospital. This immediate death could be explained by the fact that high tension wire was the most common source of electrocution in our study.

Comparative studies related to identification status

In the present study, 75 (96%) cases were identified and 3 (4%) cases were not identified. No other study with this parameter could be found.

Comparative studies related to intoxication

In this study, 4 (5.33%) cases were found to be under the influence of alcohol. Though this is an important contributing factor, no other studies could be found in this regard.

Comparative studies related to place of occurrence of injury

In the present study,most of the deaths occurred at their residence (41.33%), followed by at work place i.e industrial accidents (29.33%) and with least 8% deaths occurred in agriculture fields. Indoor household accidental electrocution (78.06%) was observed by Dokov [10]in Varna. Similar findings were observed by Byard et al [9] in South Australia, Bharath et al[6]in Andhra Pradesh, India and Gupta et al in Gujarat, India.

Comparative studies related to occupation

In the present study 60 cases (67.01%) were employed of which 8 (10.67%) cases were professionally related to this study i.e. they were electricians by profession which is a significant finding.

Comparative studies related to surrounding area of the place of incidence

In the present study, for most of the cases, the surrounding area was dry (78.67%) compared to wet which is dissimilar to the observations of Gupta et al[7] where the wet surrounding was responsible for 68 (66.67%) cases.

Comparative studies related to distribution of entry and exit wounds

In the present study, majority of electrical injuries were distributed in both entry and exit wounds in 52 cases (53.61%) followed by only entry in 6 cases (8%). Nearly 75.6% of the cases had only entry wounds while 11.4% had no entry or exit wounds in a study by Tirasci et al[5]

Comparative studies related to pattern of injuries

Inthe present study, it was observed that most number of cases i.e. 36 (48%) showed both contact marks with flash burns, followed by contact marks with 31 cases (41.33%) & 93 only 1 case showed no injury in correlation with findings of Wright and Davis[11] Vincent D Maio et al[13]

Comparative studies related to distribution of lesion site

In the present study,60 (80%) cases had electrical injury as entry in upper extremity and 29 (37.66%) cases had electrical injury as exit in lower extremity followed by lower extremity which was in consistence with the findings of other studies where 77.77% of entry wounds were observed in the upper limb and 43.75% of exit wounds in the lower limb as reported by Bharath et al[6]Similar findings were observed by Sheikazadi et al [12] and Tirasci et al [5]

Comparative studies related to causative agent

In the present study,most of the cases 49 (65.33%) were caused by high tension wire, followed by 18 (24%) cases with Home appliance injury, and only 8 (10.67%) cases were caused by faulty water pumps. Similar findings were noted in a study in Manipur by Ragui S, Th Meera et al.[14] where 60% of the cases were electrocuted by high tension wires.

Comparative studies related to cause of electrocution

In the present study, most of the cases 41 (54.67%) cases were caused due to Human negligence, followed by 18 (34.67%) cases due to faulty equipment and connections, and 8 (10.67%) were caused by lack of protective measures which agrees with a study done at Armed Forces Institute of Pathology[15]

Conclusion

Deaths due to electrical injuries constituted 0.69% among all autopsies conducted during a two year period. Electrical injuries are more common in young adult men as compared to women. Human negligence is a major cause of electrical injury. Majority of the fatalities are caused by touching high tension wires. Proper timely maintenance of electrical wires and increasing public awareness about this issue can reduce the fatality of electrical injuries. Electrocutation can be prevented by educating people about the precautions and protective measures while working with electrical equipment.

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Conflict of Interest: Nil

Source of support: Nil