ORIGINAL RESEARCH

Frequency of Electrical Contact Burns and Evaluation of the Pattern of Injury

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Received: 20 May, 2018 Accepted: 24 June, 2018

ABSTRACT

Introduction: Electric injuries are commonly classified based on their severity, such as high voltage and low voltage. Understanding the prognosis of wounds is crucial for making informed decisions to appropriately treat patients. **Materials and Methods:**An analysis was conducted on the demographic and pathophysiological features of patients with electric burn injuries in the urban region. This analysis was supported by the hospital stay duration and the therapy provided for the injuries. This is a study conducted in retrospect, therefore sample and ethical approval are not relevant. The inclusion criteria were those aged 18 years and older. **Results:**The current investigation revealed a clear seasonal pattern in the table above, with the biggest number of patients occurring between the months of June and September (49.2%). There was a somewhat smaller number of patients observed from December to March (21.1%). **Conclusion:**We suggest that preventive programs should aim to provide sufficient information, particularly during the school years. Local governments should provide personalized education to rural communities about electrical burn injuries. Simple measures, such as using local language and dialect for manufacturers' instructions and signboards, should be taken.

Keywords: Electrical injuries, high voltage, low voltage, wounds

INTRODUCTION

Laparotomy and closure of the perforation are the most commonly performed surgical technique for ileal and jejunal perforations, followed by full peritoneal irrigation with normal saline. Omental patching is a commonly used surgical procedure to close perforations in the stomach and duodenum. The procedure includes cleaning the peritoneum and placing a piece of omentum to cover the area.[1,5]of all individuals receiving treatment in burn clinics. The harm caused by electrical current is a result of two processes - heating and the flow of electric current through tissues. Heating leads to coagulative necrosis, while the flow of electrical current through tissues results in the breakdown of cell membranes.[6,7]The impact of electric current relies on the kind of current, its voltage, the resistance of the tissues, the intensity of the current, the route taken by the current through the body, the duration of contact, and individual susceptibility.

The objective of this study is to determine the occurrence of electric burns and assess the nature of the injuries.

Electrical burns differ from thermal and chemical burns. When an electrical damage occurs, heat is produced locally and the current passes directly through the tissue. Heating causes coagulative necrosis of the cells, while the current disrupts the cell membrane, resulting in tissue loss and death.[8]The extent of damage to human tissue is significant as a result of a high-voltage electrical burn. Electricity is the type of energy where electrons move from one location to another through atoms. The current refers to the movement of electrons. Electricity has the potential to cause harm or even be fatal to someone who has an electric injury. There are different kinds of electric burns that result in injuries ranging from minor to serious burns.

Electrical injuries are a form of physical harm, generally resulting from four primary categories: flame, flash, lightning, and true.Electric injuries are commonly classified based on their severity, such as high voltage and low voltage. Understanding the prognosis of wounds is crucial for making informed decisions to appropriately treat patients. When a low voltage electric current passes through a person's body between the entry and exit points, the electrical energy is converted into thermal energy, which can cause

injury to the underlying tissues. Electric entry wounds with high voltage are visibly depressed, burnt, and have a leathery appearance. On the other hand, exit wounds are typically explosive when the burned material exits.

SUBJECTS AND METHODS

We utilised patient data regarding the categories of electrical burns (low or high voltage), the ratio of burns, and the total body surface area (TBSA) burned for the purpose of conducting the analytical inquiry. An analysis was conducted on the demographic and pathophysiological features of patients with electric burn injuries in the urban region. This analysis was supported by the hospital stay duration and the therapy provided for the injuries. This is a study conducted in retrospect, therefore sample and ethical approval are not relevant. The inclusion criteria were those aged 18 years and older.

INCLUSION CRITERIA

1. All patients who came to the surgery department because of severe electric burns were included in the study.

EXCLUSION CRITERIA

Patients who arrived at the hospital more than 4 days after sustaining electric burns were not included in the study on early flap cover.

All patients were assessed using clinical methods, including a thorough examination of their medical history and physical condition. History, in particular, was encompassed.

1. The type of the current:(high voltage/low voltage)
2. Any treatment taken outside: Details of treatment:
3. Type of burn(contact/flash/arc)

THE PHYSICAL EXAMINATION WILL SPECIFICALLY INCLUDED

1. Area of contact: entry point and exit point:
2. Extent of burns[TBSA]
3. Associated injuries

[neurological/musculoskeletal/cardiac]

The patients were monitored during their time in the hospital to evaluate the ultimate result.

Imaging tests such as CT scan and MRI were performed as needed.

Consent was obtained from all the patients.

Analysed the data using statistical software with assistance from the statistician.

RESULT

The overall number of patients who had treatment for electrical burns during this time frame is 458. The overall number of patients who received treatment for burns of various types within the same time frame is 5589. This indicates a rate of 8.81% for burns caused by electricity.

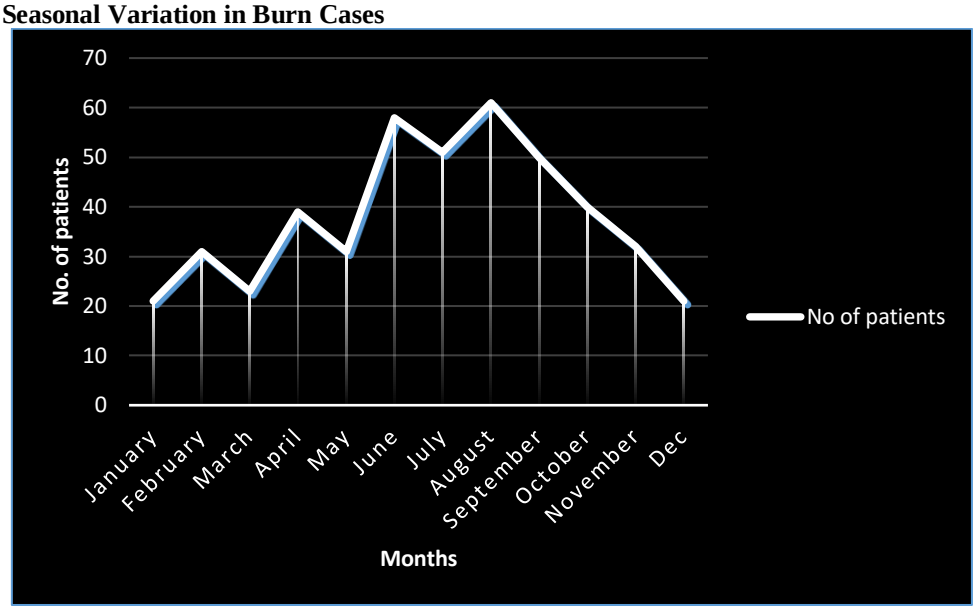
The age of the individuals who experienced electric burns varied from five months to eighty years. The age groups most impacted are between sixteen and thirty years old.

Table1: Age distribution of the patients

Age Group	No. Of Patients	Percentage
0-5	34	7.4%
6-10	40	8.9%
11-15	42	9.2%
16-20	72	17.1%
21-25	86	19.8%
26-30	51	12.2%
31-35	36	9.1%
36-40	28	7.2%
41-45	14	3.2%
46-50	23	6.1%
51-55	11	3.2%
56-60	8	2.8%
61-65	4	0.9%
66-70	5	0.7%
71-75	2	0.1%
76-80	2	0.1%

The current investigation revealed a clear seasonal pattern in the table above, with the biggest number of patients occurring between the months of June and September (49.2%). There was a somewhat smaller number of patients observed from December to March (21.1%).

Graph 1: Seasonal Variation in Burn Cases



In our research, we discovered that the primary reason for electric injuries occurred during agricultural activities in rural areas, such as working in fields. Injuries that occur within the home, particularly low voltage injuries, are the most prevalent type of domestic injuries. The second most common type of occupational injuries are those that occur while doing certain occupations such as electric company workers, electricians, individuals working in the cable sector, and industrial accidents. Electric injuries that occurred to patients while working or playing on the roof of a house were primarily caused by high voltage lines that were either located close to the house or passing nearby. Four individuals were harmed while attempting to unlawfully get electricity from power lines. Two individuals were harmed while sitting on the roofs of trains. Two further individuals were harmed while they were seated on the roof of an uncovered vehicle (specifically, a tractor) when the vehicle unintentionally made contact with overhead power cables.

Table2: Cause of electric injury

Cause of injury	No of patients
Agriculture related	189
Domestic(within home)	117
occupational	84
Roof of home(terrace)	38
Kite flying	9
Transformer near house	7
Tapping electricity	6
Sitting on train top	4
Sitting on vehicle top	4

Among the 7 head injuries, 3 did not show any unusual results on the ct scan of the head. Meanwhile, 3 had bleeding within the brain, 2 had bleeding outside the protective covering of the brain, and 2 had bleeding in the space between the brain and the surrounding tissues. Among the three patients with spinal injuries, two had a fracture dislocation at the C5-C6 level, while the other patient had a stable burst fracture at the T7 vertebrae.

During this study period, 6 patients had renal failure.

Table3: Type of associated injuries

Head injury	7
Spinal injury	3
A trial fibrillation	3
Blunt injury abdomen	2
Clavicle fracture	4
Humerus fracture	2
Femur fracture	2

DISCUSSION

The incidence and fatality rate of electrical burn injuries is relatively high. The current study aims to determine the epidemiology of electrical burns.

The study was conducted at Safdarjung Hospital from January 1, 2011 to December 31, 2011. The overall number of patients who had treatment for electrical burns during this time frame is 438. The overall number of patients who received treatment for burns of various kinds during the same time frame is 5569. This indicates a rate of 7.86% for burns caused by electricity.

This study shows that the 21 to 30 years age group has the highest number of electrical burn injuries. Out of all the patients examined, almost 31% were aged between 21 and 30 years.41% of the patients fell within the age range of 0 to 20 years. Compared to research conducted in the past 20 years, there is a noticeable change in the age range of patients towards younger individuals. Hussmann,[9]It was revealed that 26% of the patients were aged between 20 and 30 years, while 36.8% were aged between 0 and 20 years. During the 1990s, Robson,[10]A study found that 44.5% of electrical burns occurred in individuals aged 20 to 30, while only 15.6% of patients were under 20 years old. Therefore, it is clear that most of the patients seeking therapy nowadays are younger. This situation appears to be specific to electrical burn injuries. Patterns at our institution indicate that for a considerable duration, the prevailing demographic of patients seeking treatment for thermal burn injuries consists of young females in their twenties and thirties. However, there is a noticeable change in the age range affected by electrical burn injuries. It is probable that this change is due to an increase in home injuries. In poorer nations, occupational injuries were once the main cause of electrical burns. In recent years, particularly in a country like India, the economic growth has led to the availability of power even in distant areas. However, there is a dearth of awareness among people about how to handle electricity properly.

Regrettably, education and awareness have not kept up with economic expansion, resulting in the observation of these demographic changes. Despite the widespread availability of power in remote places, there have been no explicit efforts to teach people about the risks of electrical burn injuries and how to prevent them.

Out of the 438 individuals in our study, 369 were male. This indicates that a significant majority of 84.25% were male. Perhaps this is due to higher levels of outdoor activities, increased involvement in agriculture, occupational exposure, and greater interaction with electrical appliances compared to females. Increased occurrence of electrical injuries in males has been found in numerous other research such as Robson et.[12]

Children included in this study were considered to be under the age of twelve. There were a total of 81 cases, which accounted for 18.5% of all patients who were damaged by electrical burns. Most of them occurred within the home (domestic). Children sustained electric injuries when playing on rooftops of houses located close to low-lying high-voltage power lines or by approaching transformers in proximity to their residences.

There was a clear seasonal change, with the biggest number of patients occurring between June and September (48.6%). There was a relatively smaller number of patients observed from December to March (20.3%). The increased frequency during the months of June to September may be attributed to the monsoon season, which creates damp conditions that might contribute to electrical burns. It could also be influenced by the agriculture harvesting season.

During our investigation, we discovered a total of 312 injuries caused by high voltage and 126 injuries caused by low voltage. The majority of these low voltage injuries were domestic injuries caused by 240 volts. The numbers were likewise in line with Robson et al.[12]It was observed that injuries caused by high voltage were more common than those caused by low voltage.

In our research on the type of electric burn (most common), 266 patients experienced contact burns. 125 patients experienced flash burns exclusively, while 47 patients had mixed contact and flash burns. This is different from Robson et al, where there were more flash burns than contact burns.

In our research, we discovered that the primary factor for electric injuries occurred during agricultural activities in rural areas, such as working in fields. This may be because of a lack of education, limited access to agricultural information among workers and families in rural areas. An injury that occurs within the home, namely low voltage injuries, is the most common type of domestic injury. 36 instances of electric injuries were observed when patients were on their rooftops (terrace). Electric injuries sustained by individuals while working or playing on the roof of a house were primarily caused by high voltage lines that were located close to the ground or passed in close proximity to houses.Four individuals were harmed while attempting to unlawfully get electricity from power lines. Leibovic and colleagues[11]The study found that 10% of high-voltage injuries were caused by the illicit theft of copper wires.

CONCLUSION

The existing preventive strategies are largely inadequate. The main issue that limits these injuries is clearly the absence of information. We think that utilizing both passive and active methods is necessary to accomplish the objective. The government, schools, manufacturers, local authorities, and general public all need to successfully fulfill their responsibilities to address the rise in electrical burn injuries. We suggest that preventive programs should aim to provide sufficient information, particularly during the school

years. Local governments should provide personalized education to rural communities about electrical burn injuries. Simple measures, such as using local language and dialect for manufacturers' instructions and signboards, should be taken. Additionally, print and electronic media should be effectively utilized to disseminate essential information.

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