Evaluation of Demographic Characteristics and Some Laboratory Findings of Patients Presenting to Emergency Department Due to Electric Shock

İbaa Yahya

Introduction :

Electric Shocks (ES) is a problem that can cause many clinical symptoms from mild skin burns to life – threatening conditions and can be evaluated as a type of trauma in which the whole age group is at risk; at the same time, it continues to be a problem that can be prevented by some measures to be taken in our country as in the whole world (1). With the increase in technological advances, the control and widespread use of electricity has led to an increase in the number of injuries due to electric shock. According to US data, approximately 17,000 cases apply to emergency services due to electric shock per year and approximately 1000 people, %10 of whom are children, lose their lives (1 – 3).

The morbidity and mortality due to electrical shock generally varies according to different electrical current types and contact points. Generally, the mortality rate is higher in those who exposed to high voltage (>1000 volts). In low voltage (<1000 volts) which is commonly used in households and alternating current, frequent death is observed as it causes more frequent rhythm disturbances such as ventricular fibrillation. Apart from the amount of voltage, the damage can also vary depending on factors such as resistance of the skin, mucosa and internal organs, type of current (direct – alternative), exposure time, current path and body's resistance to the current (4 – 5).

The mechanism by which electric shocks cause damage is explained in three main lines. The first of these; direct effects of electric current on the human body. In the second type of injury; electrical energy is converted into heat energy without direct contact and burns deep and superficial tissues. Last one; injuries due to muscle contraction or ejection effects. Determination of risk factors and mechanisms is important in terms of precautions and treatment (6 – 7).

Electric shock is a type of trauma that can cause psychological and physical damage and cause negative effects in the society. Determination of the demographic characteristics and risk factors of electric shocks will allow the development of effective prevention methods and the reduction of such injuries (8) . Therefore, in this study; discussion of demographic characteristics, types of electrical current, laboratory findings, effect of age factor on outcome, measures to reduce mortality and morbidity of the patients who applied to the emergency department of Selcuk University Medical Faculty due to electric shock in the last 5 years, planned.

Materials and Methods:

In this study, retrospective files of 24 patients who were admitted to the Emergency Department of Selcuk University Medical Faculty between January 1, 2014 and August 1, 2019 due to electric shock were reviewed. The cases were evaluated in terms of age, sex characteristics, educational status, voltage and source of exposure, complications, state of consciousness, mortality, entry – exit of electrical current, aspartate aminotransferase (AST), alanine aminotransferase (ALT), creatinine phosphokinase (CPK), creatine kinase myocardial band (CK – MB), potassium (K), urea, creatinine, complete urinalysis (TIT) and ECG (electrocardiogram) values. SPSS 21.0 program was used for statistical analysis of the study data. The data related to quantity were presented as mean ± standard deviation; the data indicating the quality were presented as frequency and percentage value.

FINDINGS:

Table 1. Demographic and Clinical Characteristics of Electric Shock (n = 24)

Characteristic	*Mean ± SD*	*(n)*	*(%)*
Gender	Girl	7	29,2
	Male	17	70,8
Age	0 – 60 months	17	70,8
	61 months and more	7	29,2
Education	**Illiterate**	8	33,3
	Literate	4	16,7
	Primary school	5	20,8
	High school	6	25,0
	University	1	4,2
Electrical Supply	Power cable	11	45,8
	Electrical Outlet	11	45,8
	Iron	2	8,4
Complication due to ES	Skin burn	14	58,3
	Diffuse pain	2	3,8
	Normal	8	33,3
Electrical Voltage	High voltage	2	3,8
	Low voltage	22	91,7
Entry – exit of electrical current	Hand – hand	5	20,8
	Hand – uncertain	9	37,5
	Foot – Uncertain	1	4,2
	None	9	37,5

The mean age of the 24 patients who presented with electric shock was …. years. Of these, 17 were male (%70,8) and 7 were female (%29,2); %70.8 (n = 17) were 61 months or more, %29,2 (n = 7) were between 0 – 60 months. It was observed that 11 (%45,8) cases were shocked by a disrupted electrical cable, 11 (%45,8) cases were shocked by an improperly installed socket, and 2 (%8.4) cases were shocked by household electric current. Two (%8,3) of the patients were exposed to high voltage (>1000 volts) and 22 (%91,7) were exposed to low voltage (<1000 volts). While 9 patients (%37) did not have any electrical entry – exit sites; in 5 patients (%20,8) electricity entered from one hand and exited from the other hand. In 9 patients (%37,5) the hand was identified as the entry site, while the exit site was not detected.

All patients reached the emergency department with a clear state of consciousness. Also, no mortality was observed in these patients.

The most common physical examination finding (%58,3) was burns at the electrical entry or exit sites. It was noted that these were millimeter sized first and second degree burns and did

not require further treatment. Another complication due to electric shock was diffuse pain (%8.3).

All patients were evaluated by ECG for cardiac arrhythmias and all cases except two, had normal sinus rhythm findings. Sinus arrhythmia was detected in patients with ECG abnormalities and it was found to improve without further treatment in the follow – up.

Complete urine analysis (TIT) was performed in 18 patients and was found 4 positive leukocytes in 1 case, 9 positive erythrocytes in 1 case and low density in 3 cases.

In 22 cases, CK – MB and CK were performed and none of them had pathologic elevation except one. The patient with CK – MB elevation reached normal range during the follow – up period without the need for additional treatment. The mean CK values were 1468,68 ± 315,24 and the mean CK – MB was 2,7 ± 1,59. None of the patients developed renal or liver damage.

Table 2. **Some Laboratory Features of Cases Admitted to Pediatric Emergency Clinic After Electrical Shock** (n = 24)

Parameter	Mean ± standard deviation (minimum – maximum)
AST (U / L)	28.3 ± 9.68 (16-46)
ALT (U / L)	16.2 ± 5.29 (8-32)
CK (U / L)	1.37 ± 6.09 (55- 308)
CK-MB (IU / L)	2.7 ± 1.59 (0.69-5.92)
Potassium (mEq / L)	4.2 ± 0.40 (3.70-5.37)
Urea (mg / Dl)	23.6 ± 6.20 (16 - 40)
Creatinine (mg / Dl)	0.56 ± 0.22 (0.24-0.97)

Discussion:

It has been found in many studies that electric shocks in our country are more than electric shocks occurring in many countries of the world (9-10). The main reasons for this are; excessive use of illegal and uncontrolled electricity, insufficient safety of cables and electrical sources, low use of leakage current relays, uncontrolled occupational health safety and the absence of safety covers in the sockets.

Although injuries due to electric shock occur in all age groups, they are often the result of home accidents in childhood. While children under five years of age have household accidents in the form of touching electrical cables and sockets; high-voltage injuries are seen in children over five years old as a result of climbing trees or electric poles (3-11). In our study, in accordance with the literature, home injuries were found to be significantly higher in children under five years of age. When the location of the electric shock and the source of the electricity were examined, the difference between the age groups was remarkable. Sockets and electrical cables have emerged as the most important source of electricity for the preschool age group who are very keen to recognize the objects around them. The most important reasons in this age group was the sockets which were improperly installed or to which some objects were inserted and the cables which could not be covered sufficiently. In the group over the age of five, it was observed that electric household devices such as irons were more frequent than the other age group. This can be explained by the fact that older children and adolescents use electrical devices on their own. It is clear that these kinds of injuries will be prevented with simple precautions and trainings.

Electric shocks are more common among men worldwide. In a study conducted by Rai et al. it was reported that %81 of electrical shocks were observed in boys and %19 in girls. %37 of

these were due to low voltage and %63 due to high voltage (12). In the study conducted in Turkey, Cander et al. observed that %93 of electrical shocks were in boys and %7 in girls (5). Similarly, the data obtained in our study (%70.8 male and %22 female) were found to be statistically significantly higher in men. This result can be attributed to the fact that boys are relatively more interested in electrical devices and cables than girls in our culture (13).

Electric shocks can be classified as low or high voltage. Values below one thousand volts are defined as low voltage. The low voltage used in households is also alternating current. In childhood, injuries due to low-voltage alternating current are more often seen (3,5,12,13). In our study, low-voltage home accidents (%91.7) were found to be statistically significant in accordance with the literature.

None of the patients in our study had renal damage, liver damage or cardiac damage. This can be explained by the fact that the majority of the cases in our study were exposed to low voltage and/or short-term electrical current. It was considered that there is no need for further investigations in patients with low voltage, short-term exposure and no clinical signs and symptoms of deep tissue damage.

Result:

The vast majority of injuries due to electric shock in children are low-voltage, especially by home accidents. It was considered that further investigations were not necessary in cases exposed to low-voltage current and without symptoms and signs. Public education and preventive medicine are important in terms of reducing such accidents since the majority of cases presenting with electric shock can be prevented by preventive medicine practices.