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A medical approach to the 2020 Elazig earthquake

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Abstract

Objective: Besides their direct effects, earthquakes may cause death by Crush syndrome and renal factors. In this study we aimed to evaluate the medical results of 2020 Elazig earthquake.

Methods: We obtained the medical data from the National Medical Rescue Team (UMKE) and hospital records.

Results: There were 1063 injured, 45 victims who were pulled out from the rubble and 41 deaths due to 2020 Elazig earthquake. Of the hospitalized patients 33% were treated with Crush/ compartment syndrome diagnosis.

Conclusion: Catastrophic effects and collapsing buildings due to earthquakes, threat human life. In Elazig earthquake, none of the 48 hospitalized patients required dialysis probably due to early treatment and transfer to the hospital. Renal care and treatment such as fluid replacement, dialysis are as important as traumatological services in earthquakes in terms of increasing survival.

Keywords: Elazig, earthquake, crush syndrome

Introduction

Earthquakes are one of the most common causes of crush injury in the form of muscle/tissue damage caused by long-term (>4 hours) traumatic/mechanical pressure trauma to the trunk or extremities. Compressive forces act as a result of direct muscle/ tissue trauma and ischemia-reperfusion injury. The systemic presentation with AKI and other organ dysfunctions as a result of crush damage is defined as Crush syndrome. Etiology includes earthquakes, accidents, explosions, and various traumas^[1,2].

In rhabdomyolysis, in which skeletal muscle integrity is compromised, muscle intracellular components, including myoglobin, creatine phosphokinase (CK), aldolase, and lactate dehydrogenase, as well as electrolytes, are released into the bloodstream and extracellular space. As a result, electrolyte imbalances, acute kidney injury (AKI) and disseminated intravascular coagulation may result in serious life-threatening conditions^[3].

In the last 10 years, earthquakes greater than 6.6 on the Richter magnitude scale have occurred in the cities of Van, Elazig and Izmir in Turkey and have caused serious damage. The aim of this study is to evaluate the 24 January 2020 Elazig earthquake from a medical point of view and to present the data of this mass disaster to the international information database.

Materials and Methods

The data of the cases requiring outpatient/inpatient treatment/ medical support due to the 6.8 magnitude earthquake that occurred in Elazig on January 24, 2020 were evaluated based on hospital records and the data of the National Medical Rescue Team (UMKE). For this purpose, applications to hospitals in Elazig due to this earthquake and the information obtained by accessing UMKE records were examined and evaluated detailedly. This retrospective study was conducted by adhering to ethical principles with ethical committee approval.

Results

Due to the 6.8 magnitude and 20.4 seconds lasting earthquake that occurred in Elazig, Turkey on January 24, 2020; we have reached the information that there are 1063 injured, 45 victims who were pulled out from the rubble and 41 deaths. Of the 48 hospitalized patients, 16 (33%) were treated with the diagnosis of Crush/ compartment syndrome and 11 (22%) with extremity fractures.

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A total of 2700 mobile rescue/ health personnel from 77 provinces were assigned for the Elazig earthquake, and a total of 9 medical endpoints (disaster medical aid centers) were established in the first 4 days and health services were started to be provided. The highest creatinine (Cr_{max}), creatine kinase (CK_{max}) and potassium (K^+_{max}) values detected during the course of hospitalization of 12 patients who were hospitalized in Firat University Hospital are presented in the table 1.

Table 1: The highest Cr, CK and K^+ values of the patients hospitalized in Firat University hospital after the earthquake.

Patient	Cr_{max}	CK_{max}	K^+_{max}
1	0.78	1790	5.1
2	0.91	1028	4.2
3	0.95	675	5.2
4	0.97	2028	4.2
5	1.04	2143	4.7
6	0.76	387	4.9
7	0.55	-	5.9
8	0.69	51740	5.7
9	0.56	2380	5.1
10	0.48	46	5.2
11	0.79	184	4.3
12	0.69	-	5.6

Discussion: Earth's crustal movements and ruptures, called earthquakes, are natural events that are almost a normal part of human life. According to the data of the Turkish Disaster and Emergency Agency (AFAD), more than 30 thousand seismic movements were recorded throughout Turkey in 2020^[4]. In the earthquake that occurred in Elazig on January 24, 2020, more than a thousand people were injured and 41 deaths were recorded. Of the cases requiring hospitalization, 33% (16/48) were followed up and treated with the diagnosis of Crush/compartiment syndrome and 22% (11/48) with extremity fracture^[5].

On the other hand, 5302 hospitalizations and 639 Crush Syndrome cases were recorded in the 1999 Turkey/Marmara earthquake. Higher numbers of deaths, injuries and Crush syndrome cases in the Marmara earthquake can be attributed to the fact that the earthquake was seismically larger, lasted longer, and perhaps there were more limited intervention possibilities compared to today^[6].

The most common causes of death in mass crush injuries are the direct effects of trauma and Crush syndrome. Of those trapped under the debris 80% die within minutes (due to traumatic asphyxia, traumatic brain injury, severe hemorrhagic shock), 10% survive with minor injuries, 20-70% of 10% develop rhabdomyolysis- Crush Syndrome and 20% of these results in mortality (due to AKI, multiorgan failure, hyperkalemia). On the field; while the person is still under the rubble, fluid therapy should be started immediately by the most appropriate route available^[7].

Rescue activities in earthquakes should not be less than 5 days, considering the duration and the number of people who can be rescued^[8].

Rhabdomyolysis causes AKI due to decreased renal perfusion, vasoconstrictor cytokine release, acute tubular necrosis due to myoglobinuria, tubule obstruction (heme pigment-induced cast nephropathy) and some other factors (hyperphosphatemia, hyperkalemia, hyperuricemia, nephrotoxic drugs, free oxygen radicals, iron ions, infections, shock, heart failure, arrhythmias etc.)^[9].

During the evaluation after the earthquake, time should not be lost for patients who do not have a chance to survive, attention should also be paid to the apparently mild patients in terms of Crush syndrome, and also, to the urine color of the patients, and to hyperkalemia especially in those with severe muscle damage, male patients, athletes. Empirical hyperkalemia treatment should be started in those with the risk of hyperkalemia^[7].

Time under the rubble is not a negative predictor of survival and renal dysfunction, as only mild/moderately injured patients can survive long under rubble. Mortality is around 20% in rhabdomyolysis-related AKI cases, and this rate increases further in multiple injuries and multiple organ failure^[10].

According to the data of the Iran-Bam earthquake, the need for dialysis increased as the time under the collapse was prolonged^[11]. On the other hand Kobe and Marmara earthquake data revealed a negative correlation between the time under the collapse and the need for dialysis, and, CK levels. The researchers attributed this to the early death of those with severe muscle damage and high CK levels under the collapse^[12, 13].

On the other hand, in the 2020 Elazig earthquake, none of the cases required dialysis. The patients who were hospitalized in the Firat University hospital due to the Elazig earthquake did not have serious increases in serum creatinine and potassium levels and that there was a moderate increase in creatine kinase levels and, this was attributed to the fact that the victims were started to treat early in the disaster area and were transferred to the hospital without being under the collapse for a long time.

Fluid resuscitation in earthquake survivors should be initiated prior to salvage—before heme pigment and other intracellular elements are released into the circulation, and fluid escape into the damaged muscle compartments. It is recommended to choose isotonic saline or isotonic saline + 5% dextrose mixture liquids. Fluid therapy should be continued in post-rescue follow-ups, taking into account the patients' urine output and volume status^[2, 14].

It is known that appropriate fluid resuscitation reduces the need for dialysis^[15]. On the other hand, peritoneal dialysis and hemodiafiltration, especially intermittent HD, can be applied as renal replacement modalities in established AKI due to Crush syndrome^[16].

Conclusion

Earthquakes are mass disasters and can be fatal both by their direct effects and as a result of crush injuries. Renal care and treatment are as important as traumatological services in earthquakes in terms of increasing survival. Appropriate fluid replacement, close monitoring of renal functions and, dialysis applications should be performed when necessary and, Nephrologists should be a component of the multidisciplinary medical team in disasters.

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