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ORIGINAL ARTICLE

Panic related injuries after the Athens earthquake in July 2019

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ABSTRACT

Earthquakes are devastating events. Greece is known to be one of the most active seismic regions worldwide. Recently a 5,1 Richter earthquake shook Athens, fortunately without harmful construction damages in the metropolitan area. The aim of the prospective case-series study, is to evaluate the type, pattern and severity of the injuries, as well as the type of orthopedic surgical procedures that were performed, in addition to the effect of panic on the occurrence of these injuries. The study included 18 patients with a total of 23 injuries. Thirteen fractures were reviewed. Four patients underwent surgery, where open reduction and internal fixation applied in 2 cases, external fixation performed in 1 patient and another patient submitted to tibial intramedullary nail fixation. Six patients (33,3%) were <40 years old. None of the injuries caused by building collapse but by the panicked patients trying to escape. We aim to highlight the effect of panic as an independent aggravating factor during natural disasters, where regardless of age can lead to very serious injuries and fractures even in cases where the buildings damage in the metropolitan area is negligible.

KEY WORDS: Earthquakes, Panic, Orthopaedic Trauma

Background

Almost 500.000 earthquakes take place every year. Approximately 3000 of them are perceptible to humans, of which more than half (seven to eleven) result in a significant loss of life [1]. Since 2000, major earthquakes have taken over 800.000 lives worldwide and injured countless more [2]. That number will increase due to population aggregation in seismically active regions [3]. Greece is known to be in the 1st place of seismicity in Europe and 6th worldwide. Greece is located at the intersection of the African and Eurasian tectonic plates. The relative motion of these two plates against each other and resultant collision, leads to the release of high amount of energy in the form of earthquakes with variable magnitude [4].

There have been more than 35 large earthquakes,

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TABLE 1.

Age's data of patients group

Age of the patients (Years)	n
<20	1
20-40	5
40-60	4
60-80	6
>80	**2**

TABLE 2.

Mechanism of injury

Mechanism of injury	Patients
Injury while running	9(50 %)
Fall from height/ladder	5(27,7%)
Violent traction	4(22,2%)

TABLE 3.

The distribution of orthopedic injuries in percentage across the body

	Patients
Upper extremities	
humerus/shoulder	5 (21,73 %)
elbow/olecranon	3 (13,04%,)
radius	1 (4,34 %)
Lower extremities	
knee	1 (4,34%)
tibia	3 (13,04 %)
fibula	1 (4,34%)
ankle joint	4 (17,39%)
calcaneus	1 (4,34%)
metatarsal bones	3 (13,04%)

above 6 Richter during the 20th and 21st centuries in Greece. On 19 July 2019, a 5,1 magnitude -followed by more than 200 aftershocks- struck 23 km northwest of Athens. The geographical coordinates of the epicenter were 38°11°80° N, 23°52°45° located in Magoula region, which rendered the earthquake perceivable in the metropolitan area of Athens. On the next few hours, there were over 1500 minor or major damages in buildings and constructions.

Objective and methods

On 19 July 2019, in Attica, General Hospital-KAT, which is a level 1 trauma center, was faced with all the injuries of the earthquake. Within the early hours after the earthquake, all the patients who sustained trauma arrived at the emergency department of our hospital. They all received a detailed total body clinical examination in combination with radiological and clinical testing where necessary. It soon became apparent that none of them suffered trauma due to a building collapse, on the contrary they all got injured in their attempt to protect themselves escaping the scene. A total of 18 patients suffering from a minor injury to a complicated fracture, received medical attention. The study focuses on the features of orthopedic earthquake-related injury, assessing the type and the severity of these injuries as well as to the type of surgical procedure that applied. Evaluating variables such as the demographic data, we aim to highlight the importance and severity of orthopedic injuries as a result of the aggravating effect of panic even in a country which is accustomed to such natural disasters. Most of the patients were female (n=11– 61, 1%), 7 were male (38,9%), with the age of patients varying between 20 and 84 years old (mean 54,9 yr.) (**Table 1**).

Fourteen patients (70%) suffered injuries while running to get out of the buildings, 3 of whom fall from stairs and the other 4 sustained injuries indirectly by relatives or friends after an abrupt traction in order to leave the scene (**Table 2**). Lower extremities are involved in 13(56, 52%) of the 23 types of injuries and upper extremities in 9(39,13%) (**Table 3**). There was only one patient with a head injury and no orthopedic lesion and

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TABLE 4.

Most devastating earthquakes since 1980 [5].

DATE	LOCATION	MAGNITUDE	INJURIES	DEATHS
21-07-2017	Kos	6,6	150	2
06-12-2017	Lesvos	6,1	15	1
17-11-2015	Lefkada	6,5	4	2
24-05-2015	Limnos	6,9	1	1
15-07-2008	Aegean Sea	6,4	-	1
08-06-2008	Peloponesse	6,4	240	2
07-09-1999	Athens	6	1600	143
15-06-1995	Aigio	6,4	60	26
13-05-1995	Kozani	6,6	12-25	-
13-09-1986	Kalamata	6,2	300	22

was referred to the neurosurgery department for further treatment.

Results

Injuries involving the elbow area included an olecranon fracture, a minor injury and a skin wound. As far as the shoulder area was concerned, there were 3 shoulder dislocations due to abrupt traction, two of whom had respectively an associated Neer II greater tubercle fracture and a Neer II subcapital humerus fracture. One patient suffered from a distal radius fracture (Colles' fx) as a consequence of a fall of its own height and another one brought by the emergency department because of a minor knee injury. Tibia was involved in 3 cases (13, 04%) including a skin wound, a pilon fracture and a tibial shaft fracture with an associated drop foot as result of an ipsilateral common peroneal nerve injury after closed fibular head avulsion fracture. Most of the lower limb injuries affected the area of the ankle and foot (n=8 - 34,78%) were consequence of ankle sprain which imply to 4 lateral malleolar fracture, 2 avulsion fractures of the distal phalanges of the 5th metatarsal bone and a calcaneus fracture caused by a fall from height and a skin wound. There weren't any open fractures.

Treatment-Surgical Procedures

A total of 13 fractures were reviewed. Four patients were admitted to the hospital and they all underwent a surgical procedure, unlike the other 14 where a conservative treatment was applied. Patients with malleolar fracture and 5th metatarsal bone fracture were treated conservatively with a plaster. A pregnant patient was referred to the obstetrics department for further evaluation.

As far as the planning of the surgical procedure was concerned, the use of computer tomography was required in order to evaluate the fracture pattern of the calcaneus and the pilon fracture. Open reduction and internal fixation performed to the calcaneus and olecranon fracture (plate and screw fixation and a k-wire tension band, respectively). Tibial pilon fracture was treated using an Ilizarov external fixation system, while the patient who suffered a tibial fracture underwent an intramedullary nailing. The soft tissue envelope condition in the calcaneus and the tibial pilon fracture did not allow an early surgical procedure, hence the average length of hospitalization was 11.5 days (range, 2 – 18 days). A weekly to monthly postoperative follow-up suggested to all the patients who sustained a fracture.

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Discussion

Greece is the most earthquake-prone country in Europe. In recent decades, the social and economic damage has been enormous, while simultaneously mourning the loss of human lives. Table 4 shows the most devastating earthquakes in Greece since 1980.

Despite the fact that Greek citizens are accustomed to high seismic activity, the earthquake-related injury incidence is often considerable and the overwhelming majority of them are mostly orthopaedic. According to Mackenzie et al, more than 80% of survivable injuries sustained in earthquakes are orthopaedic in nature [3]. Del Papa et al, in a retrospective analysis following the earthquake in L'Aquila City, pointed out the higher frequency of female than male patients among natural disaster, which has been also noted in other studies [4]. In addition, a remarkable male to female ratio of 1:2.4 noted by Emami et al, in the Bam earthquake in Iran [6]. This difference between males and females dealing with a sudden catastrophic event can be attributed to both traditional stereotyping and cognitive appraisal of threat [7-9]. Bar-On et al, in their review about the Haiti earthquake, pointed out that the number of injuries can be affected proportionally to factors including the magnitude, the day and the time of the event [10].

Fortunately, the magnitude of the recent earthquake was lower in comparison to those shown in table 4, thus the sample of our study is small. In addition, the main shock of the earthquake was recorded during day time and this probably acted as a protective mechanism as citizens were involved in their daily routine. We recorded a male to female ratio of 1:1.6 and this is accordance to the literature. We would like to emphasize the fact that all presented injuries were due to panic effect and no injury was a crushing result of construction damages as the medical history of the patients revealed. Self control and the strict obedience to the instructions of the Ministry of Citizen Protection is mandatory, especially as far as the first spontaneous reaction is concerned.

Conclusions

Earthquakes in Greece present health implications and social consequences. Although there weren't harmful construction damages, patients underwent fractures or injuries due to the panic effect. Citizen's education is the proper tool in reducing these types of injuries.

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