



Musculoskeletal Related Injuries After 2017 Kermanshah Earthquake

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Abstract

Objectives: This study aims to investigate the pattern of Musculoskeletal and soft tissue injuries in a series of referred patients in a tertiary medical center and review previous reports in the literature.

Methods: In this study, we recorded musculoskeletal injuries of the victims, following the Kermanshah earthquake on November 12, 2017, with a total number of 38. All patients were admitted to the Imam Khomeini Hospital. Injury type, site of injury, gender, age, complications, mortality, and treatment modality were recorded for each case.

Results: Among 38 patients, 18 were male (47%) and 20 were female (53%). The mean age was 37 ± 21.6 years. Most of them were aged between 18 and 65 (71.1%). Lower extremities were involved more than the upper (37% versus 24%) and distal limb involvement was more than the proximal (57.3% versus 43.7%). One patient died due to necrotizing fasciitis and septic shock after femoral shaft open fracture. Two patients developed compartment syndrome and underwent fasciotomy complications by skin necrosis and infection.

Conclusions: Soft tissue injuries and fractures are the most common injuries following the earthquakes, hence orthopedic surgeries play a vital role in disasters. Despite patients overload and emergency situation in natural disasters like earthquakes, it is crucial to have a stepwise and evidence based approach for each patient. For the patients with open fractures referred to a tertiary center, careful contamination assessment even in the previously managed wounds is highly recommended, especially for those with early wound closure. Early fasciotomy in the crush syndrome is not beneficial as it has adverse effects such as skin necrosis and infection.

Keywords: Earthquake, Disasters, Iran, Orthopedic Procedures, Musculoskeletal Injuries

1. Background

Natural disasters lead to enormous loss of life and economical forfeiture (1). Tsunamis and floods result in higher mortality, whereas higher morbidity occurs as a result of earthquakes, mostly orthopedics (1-3). Considered as one of the most frequent natural calamities, there were at least 8000 deaths and 26,000 injuries due to the earthquakes each year (4). After the management of the life-threatening injuries, the leading causes of morbidity are assumed to be soft tissue and extremities injuries (5-7). On November 12, 2017, at 21:18 p.m. local time, Kermanshah, Iran, the region of Sarpol-e Zahab, was struck by a 7.3-Richter earthquake. As the earthquakes affect a great deal of victims, better epidemiological knowledge of the injuries is essential for improving the disaster management (8-13). This study aims to investigate the pattern of the Musculoskeletal and soft tissue injuries in a series of referred patients in a tertiary medical center.

2. Methods

In this study, we recorded musculoskeletal injuries of the victims, a total number of 38, who were transported by airplane to our hospital, a tertiary medical center (Imam Khomeini Hospital). Injury type, site of injury, gender, age, complications, mortality, and treatment modality were recorded for each case. All of the patients received first aid treatments. The individuals who were candidates for surgery received pre-operative antibiotics. Strict glycemic control was performed for the patients with a history of Diabetes Mellitus. The final diagnosis of the injuries was made by the hospital physicians, based on clinical signs, symptoms, and necessary imaging.

3. Results

A total of 630 people died and more than 7,000 were injured as a result of the earthquake (14). More than half of the Iranian casualties were from Sarpol-e-Zahab and the Ezgeleh district, which had a population of over 30,000.

At least 7 people died and another 500 injured in the adjacent area in Iraq, according to their officials (15). About 70,000 individuals, from 14 Iranian provinces, became homeless. The earthquake completely destroyed around 12,000 houses and damaged another 15,000 (16).

In total, 38 injured patients were admitted to our hospital on November 13, 2017. Of the patients, 18 patients were male (47%) and 20 patients were female (53%). The mean age was 37 ± 21.6 years. A total of 18.4% of the patients were under the age of 18, 71.1% between 18 and 65, and 10.5% above 65 years. There were more females than males in patients below 65 years of age (Figure 1). Spine, lower, and upper limb involvement was noted in 6 (16%), 14 (37%), and 9 (24%) of the individuals. Of the patients, 7 (18%) of them had pelvic fracture and 8 (21%) had no fractures (Table 1). Proximal limb involvement (Femur and Humerus) was noted in 7 (43.7%) and distal limb involvement (Tibia, Ulna and Radius) was noted in 16 (57.3%) of the patients. Acute renal failure emerged in 1 patient (2.6%).

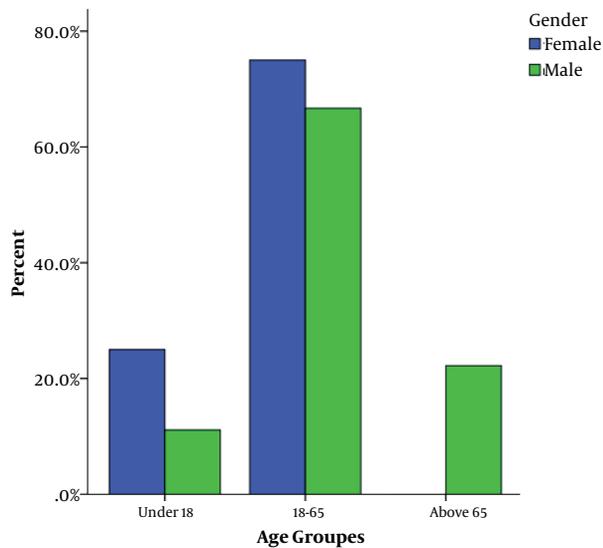


Figure 1. Age Groups and Gender Distribution

One patient (2.6%) died due to septic shock, he was a 30-year-old man who had femoral shaft open fracture. The initial measures including wound approximation were taken before admission in this center. The vital signs became unstable in the 1st hours; the blood pressure was about 66/55 mmHg and the heart rate 150 Bpm. The clinical examinations were assumed to be in favor of hypovolemic shock, thus, Aggressive Resuscitation was performed, however, there were no ameliorations and the patient intubated within the next few hours. A total of 15 hours later, the patient underwent surgery for temporary stabilization with

Table 1. Distribution of the Fractures and the Treatment Based on the Anatomical Sites

Localization	No. (%)	Number of Surgeries	Number of Conservative Therapies
Lower limb fractures			
Femur	5 (35)	5	
Foot	4 (29)	3	1
Ankle	4 (29)	4	
Leg	1 (7)	1	
Upper limb fractures			
Scapula	1 (12.5)		1
Arm	1 (12.5)	1	
Forearm	1 (12.5)	1	
Wrist	2 (25)	2	
Elbow	1 (12.5)	1	
Hand	3 (37.5)	3	
Spine	6 (16)	2	4
Pelvic	7 (18)	2	5

external fixator. Massive Purulent discharge was noted and as the wound explored, extensive necrotizing fasciitis and myonecrosis were seen. The wound was probably contaminated by the patients own fecal. Being in septic shock and fasciitis extending to the proximal of the lower limb, hip disarticulation was performed. Unfortunately, Later aggressive irrigation and debridement's were not successful, and the patient died 48 hours later.

There were 2 patients (5.26%) that experienced compartment syndrome. Early fasciotomy was done for both of them. Both were complicated by an infection and stayed in the hospital for more than 1 month.

Two patients (5.26%) experienced cervical spine fracture dislocations. Both of them underwent early surgery within 12 hours. One of the patients who had normal neurologic examination prior to surgery, fully recovered after surgery and discharged 3 days later. However, the other one who had complete paraplegia prior to surgery did not recover.

One patient experienced paraplegia without a fracture or cord injury in neither the CT scan nor the MRI of the spine. He fully recovered gradually and was discharged 1 week later. The diagnosis was assumed to be the crush syndrome of the spine with no structural abnormality.

4. Discussion

Earthquakes are one of the most fatal mass impact humanitarian disasters, causing a high mortality and morbidity each year. Population density of the region, time of day of the earthquake, and building infrastructure quality are the factors determining the extent of the damage (17). Similar to us, Kaim Khani et al. noted that young people, especially females, are more susceptible for orthopedic injuries (18). On average, pediatrics are affected more, both in developing and developed countries (19, 20); however, Sarisozen and Durak stated that compared to the adults, pediatrics have lower amounts of injuries but the same severity (21).

4.1. Percentage of Orthopedic Injuries

Limb injuries are considered as the most common injury, accounting for 54% - 66% (22-24). A total of 77% of the total victims from the Bam earthquake in Iran (25), 84% in Van earthquake in Turkey (26), 88% in Wenchuan earthquake in China (27), 89% in Battagram in Pakistan (18), and Gujarat earthquake in India (28) had orthopedic injuries. In our study, 8 (21%) of the patients had no fractures and 1 of the injured patients had a head injury. The other 29 patients (76%) had orthopedic related injuries, similar to previous reports.

Fractures, crush injuries, and soft tissue injuries are considered to be the most common type of orthopedic-related injuries (25-27, 29).

4.2. Anatomic Distribution

Following the 2001 India earthquake, among 281 orthopedic injuries, lower limbs were affected the most with 204 (72%), followed by upper limbs 57 (20%), and pelvis 20 (8%) (30) injuries. Similar results from Iran (25, 31), Turkey (26, 29), Haiti (32, 33), Nepal (34, 35), China (27, 36), and Pakistan (18, 37) were reported, demonstrating high prevalence of the lower limb fractures, followed by upper limbs, and pelvis. The proximal bone involvement is greater if the earthquake happens early in the morning (as most people are asleep) and it is assumed that proximal bones are more involved generally (25).

In our study similar results were found, lower limbs affected 37%, upper limbs 24%, and pelvis 18%. According to the previous studies, pelvic injuries include a small portion of the injuries, which may be due to the fact that patients died before reaching the hospital (38). In our study 7 people (18%) had a pelvic injury, 2 of them underwent surgery, and conservative therapy was chosen as the treatment for the rest of them.

4.3. Orthopedic Procedures

Orthopedic procedures following an earthquake include debridement, external fixation, open reduction, and internal fixation (ORIF), close reduction and casting, as well as amputation. Debridement is the most common type of procedure (26, 29, 32), however, there is a significant difference in the other treatments in previous reports. Guner et al. reported (29) the greatest number of patients who received orthopedic procedures. Among 370, the most common procedure was debridement (45%), followed by ORIF (24%), CR and casting (20%), external fixation (8%), and amputation (3%). Phalkey et al. (30) reported debridement in 26%, close reduction and casting in 30%, ORIF in 28%, external fixation in 1%, and amputation in 11% of the patients. Bar-On et al. (32) reported debridement in 68% of cases followed by external fixation in 55% of cases. In our study, 4 patients (13%) underwent debridement, 20 patients (66%) ORIF, 1 case (3%) needed external fixation, and 1 (3%) patient underwent amputation.

The importance of the limb salvage surgeries, in the situations other than disasters, is obvious (39). It matters more when a natural calamity happens in a poorer economy (40). Despite good rehabilitations after the amputation (41), the individuals will encounter financial problems following that (40, 42).

4.4. Open Versus Closed Fracture

Open fractures usually occur after the earthquakes, however, not more than closed fractures. Open fractures occur in 8% - 13% of the affected people (27, 30). In the Pakistan earthquake in 2011 open fractures were reported as 35% and closed fractures 65% (18). In Nepal (34), Haiti (32), China (27), and Turkey (26, 29) open fractures were 27%, 28%, 34%, and 14%.

Similarly, in our experience, only 4 (12%) open fractures were seen. One of them complicated by necrotizing fasciitis, which led to death and 2 of them complicated by skin necrosis and infection. One patient underwent external fixation without any complications.

4.5. Crush Syndrome and Compartment Syndrome

Among 228 orthopedic-related injuries, Tahmasebi et al. (25) reported 6 patient with (2%) crush syndrome and 18 (6%) patients with compartment syndrome. In China earthquake, Dai et al. (27) reported 19 cases (7%) of crush syndrome and 18 cases (6.5%) of compartment syndrome.

Crush syndrome among pediatric patients was reported by Iskit et al. and Donmez et al. (43, 44). Sarisozen reported acute renal failure as a result of Crush syndrome (21). In our patients, compartment syndrome happened in 2 of them and 1 of the patients had acute renal failure, none

of them were among the pediatric group. Both of the patients who underwent fasciotomy were complicated by infection. Due to the fact that in crush injuries the muscles are already dead, fasciotomy is not indicated to save at-risk muscles like other forms of compartment syndrome. As previously noted, routine fasciotomies does not only not improve outcomes, but it also increases the risk of renal failure, wound infection, and sepsis related to wound infection (45-48).

4.6. Infection

The range of infection is estimated to be 19% - 35% (49, 50). Risk factors for infection include multiple bone fracture, crush syndrome, amputation, and paraplegia (51-53). Infection was seen in 3 patients in our experience. All of them as a complication of open fracture; 2 patients were treated successfully with antibiotics, irrigation, as well as debridement and skin graft. The last patient with femoral shaft open fracture complicated by necrotizing fasciitis died due to septic shock.

As previously discussed (54, 55), early removal of foreign bodies and organic contaminations (56) accompanied by early irrigation and debridement in the first 24 hours play a crucial role in improving the outcome of open fractures (57, 58). Our unpleasant experience throws the light on this fact that if the wound has been primary closed or approximated, wound reassessment is important. Careful patient examination should be done due to contamination possibility. In addition, primary closure of the wounds in open fractures should be done after precise physical examination and careful assessment. Our patients' wound was contaminated by fecal and primary closure was contraindicated (59). Opening the wound, removal of organic contamination, and early and aggressive irrigation and debridement could probably save our patients' life.

Earthquake-related injuries cause long-term morbidities and quality of life decrement (60). Preventing mortality and decreasing morbidities, adequate and short-time aid is crucial (50, 61), in this regard, preparation and planning is suggested for a better disaster management and avoiding further mortality and morbidity. Moreover, it is crucial to have a stepwise and evidence based approach for each patient. For the patients with open fracture referred to a tertiary center, careful contamination assessment, even in previous managed wounds, is highly recommended, especially for those with early wound closure. Besides, not having proven advantages, early fasciotomy in crush syndrome is not suggested.

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