

## CASE REPORT

# Spinal Injuries Profile in 2018 Palu-Donggala Earthquake and Tsunami, Indonesia

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## ABSTRACT

**Background:** On September 28th 2018, an tectonic earthquake with 7.4 Richter scale magnitude hit Donggala Regency and Palu City, Central Sulawesi, leading to thousands death and hundreds injury. This study retrospectively reviewed spinal injured patients' profile that had been referred to Wahidin Sudirohusodo Hospital, Makassar, South Sulawesi, Indonesia.

**Method:** This was descriptive retrospective study of spinal injured patients referred to our hospital. The imaging and clinical data were collected by using medical record regarding the gender and age, causal relationship with the disasters, anatomical location of the injury, severity of spinal cord injury based on neurological deficit, fracture pattern, and treatment of choices.

**Result and Discussion:** From fifteen patients, the mean age was  $42.67 \pm 20.09$  (15-80) years old. Most of the patients (14 cases, 93.33%) was strucked by building materials related to earthquake Thoracal and lumbosacral region are the most affected site, each of them is 6 cases (40%) respectively. As many as 7 patients (46.67%) had burst fracture pattern Neurological examination revealed 7 patients (46.67%) with ASIA E score. Ten patients (66.67%) had been recommended to undergo decompression and/or posterior stabilization with mean operation time was  $2.32 \pm 0.6$  (range: 1.3 – 3.50) hours.

**Conclusion:** Devastating disaster in Palu-Donggala, Indonesia remain a long-lasting disability for many spinal injured patient. Numerous improvement should be established as an integral part of holistic disaster management.

**Keywords:** spinal injury, earthquakes, natural disasters.

## INTRODUCTION

Earthquakes are one of the most destructive natural disasters leading to catastrophic damage, possibly followed by high ocean wave formation called Tsunami, leading to even more severe devastation.<sup>1</sup> Physical and psychological injuries build the most difficult problems according to emergency aid and treatment after the disaster.<sup>2</sup>

At 17:02:44 Central Indonesian Time (9:02:44 Greenwich Mean Time) on September 28<sup>th</sup> 2018, an tectonic earthquake with 7.4 Richter scale magnitude, as the result of Palu-Koro fault movement, took place in 26 kilometres north of Donggala Regency and Palu City, Central Sulawesi with 11 kilometers depth of hypocentrum, followed by a 3 meters Tsunami wave, six minutes after and 508 aftershocks occurred following the main earthquake.<sup>3</sup>

A report from National Board for Disaster Management stated that the death toll from this disaster rose to 2,073; 4,084 peoples were injured and 671 peoples were missing within a devastated area of 284,27 km<sup>2</sup>.<sup>3</sup>

the infrastructures of the region (electricity, water supply and gas) hardly survived. Thousands buildings including hospitals and health care centres was also destroyed, as well as half of local airport runway, making evacuation and aid a challenging attempt.<sup>3</sup>

Due to limitation of on-site health service for injured victims, immediate and elective evacuation of the patients was carried out to neighboring hospitals. Wahidin Sudirohusodo Hospital as the referral central of Eastern Indonesia became one of the first choices. In this study we retrospectively reviewed and described spinal injured patients' profiles that had been referred to our hospital.

## METHODOLOGY

### Demographics

Among 355 patients referred to Wahidin Sudirohusodo Hospital, 220 were injured that need orthopedic care, including 17 patients with spinal problems. Two of them was later diagnosed with spondy-

litis tuberculosis (non-traumatic spine disorder) hence excluded from this study. The imaging and clinical data of the patients were retrospectively collected by using medical record regarding the gender and age, causal relationship with the disasters, anatomical location of the injury, severity of spinal cord injury based on neurological deficit, fracture pattern, and treatment of choices.

Classification and scoring of injured patients

ASIA Impairment Scale (AIS) classifications were used to determine the neurological deficit as modification of Frankel’s classification.<sup>4</sup> ASIA A is defined as a person with no motor or sensory function preserved as level S4-S5. ASIA B is defined as sensory but no motor function is preserved below the neurological level and includes the sacral segment S4-S5. ASIA C is defined as motor function preservation and more than half key muscles below the neurological level have muscle grade less than 3/5. ASIA D is defined similar to ASIA C, but with muscle grade of 3/5 or more. ASIA E is defined as normal motor and sensory function. Injuries without any fracture were considered as minor spinal injury.<sup>1</sup>

RESULTS

Based on clinical record, 15 patients (2 males and 13 females) from total patients referred to our hospital had spinal injuries during the earthquake followed by tsunami in Palu and Donggala. The mean age of the patients was  $42.67 \pm 20.09$  (range: 15-80) years old. We detected 12 major injuries (80%) and 3 minor injuries (20%). Most of the patients (14 cases, 93.33%) was strucked by building materials related to earthquake, while only one patient (6.67%) was due to rolled by Tsunami wave.

Thoracal and lumbosacral region are the most affected site, each of them is 6 cases (40%) respectively, and 3 cases (20%) without any fracture. As many as 7 patients (46.67%) had burst fracture pattern, five patients (33.33%) had fracture-dislocation of vertebra, and 3 patients (20%) shows no fracture from radiologic workup.

Neurological examination revealed 5 patients (33.33%) had ASIA A score, 1 patient (6.67%) had ASIA B score, 2 patients (13.33%) with ASIA C score, and 7 patients (46.67%) with ASIA E score.

After thorough assessment for each patient, ten patients (66.67%) had been recommended to undergo decompression and/or posterior stabilization with mean operation time was  $2.32 \pm 0.6$  (range: 1.3 – 3.50) hours. One patient (6.67%) had been performed percutaneous vertebroplasty with one hour operation time. Two patients (13.33%) was recommended to use thoracic-lumbar-sacral orthosis

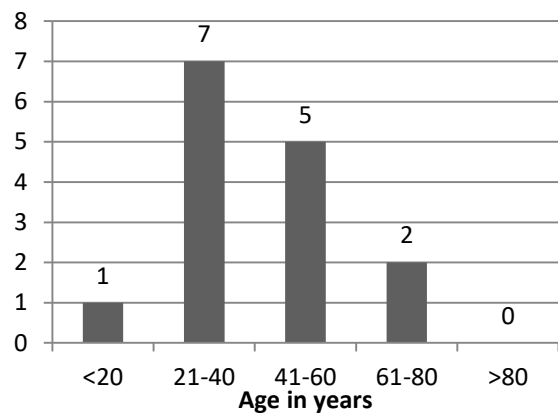


Figure 1: Age distribution of patients

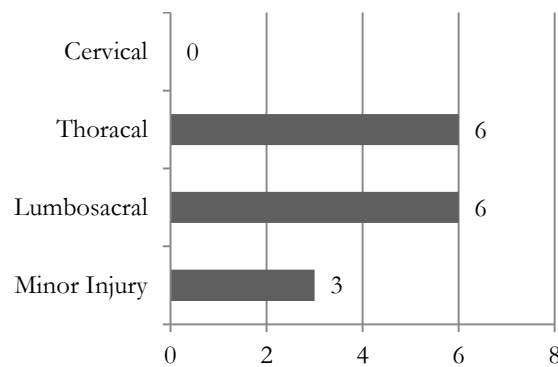


Figure 2: Region of Injury

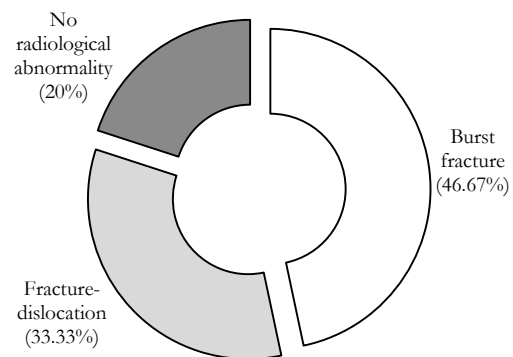


Figure 3: Pattern of fracture

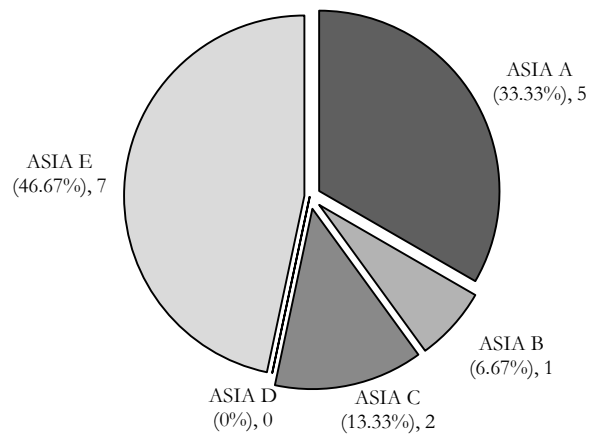


Figure 4: ASIA class

(TLSO) and the rest two patients (13.33%) had been treated using analgetic medication alone.

Average length of stay for treated patients was  $13.27 \pm 5.97$  (range: 3 – 20) days.

## DISCUSSION

Beside magnitude, hypocenter depth is a crucial factor affecting the destructive power of an earthquake while the geographical environment, population density and health-care services of the area are closely related to the extent of casualties.<sup>5</sup> Palu and Donggala is located by the Makassar Strait, hence enabling Tsunami wave formation.

In this study, most injuries involved thoracal and lumbar region, along with study performed in Sichuan earthquake in 2008 where almost 55% injuries were involving lumbar region.<sup>6,7,8</sup>

Furthermore, our study showed that majority radiologic fracture pattern was burst fracture (46.67%), comparable with Dong et al. that indicated 58.1% of their study suffered from burst fracture.<sup>7</sup> Similar fracture pattern was found in 2003 Bam earthquake where 48.7% of patients suffered burst fractures.<sup>9</sup>

While only 21% of spinal injured patients in Sichuan suffered from complete neurological deficit, our study shows inverse data as majority of patients (46.67%) classified as ASIA class E.<sup>7</sup> However, our study shows similar results with Pakistan earthquake in 2005 where 89.3% of injured persons had paraplegia, as well as 81% of patients in 2015 Nepal earthquake.<sup>8,10</sup>

Several factors such as incident happened in evening while most of people already gather in their home, inadequate natural disaster alarm, until improper victims evacuation may contribute to severity of neurological disorder in spinal injured patients.<sup>11</sup>

## CONCLUSION

Devastating earthquake followed by tsunami that took place in Palu-Donggala, Indonesia remain a long-lasting disability for many spinal injured patient. Numerous improvement from natural disaster alarm, early assessment of patients and continuous public education in evacuating injured victims should be es-

tablished as an integral part of holistic disaster management.

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