The motor function and activities of daily living capacity of seismic wounded patients in intensive care unit ward in 5.12 Wenchuan earthquake of China

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Objective: To describe the motor function and activities of daily living (ADL) functional status of the seismic wounded patients treated in the intensive care unit (ICU) ward, and to provide insight to the planning on their clinical rehabilitation program. Method: A prospective study. Trained assessor applied different common testing methods to measure the motor functions of seismic wounded patients treated in ICU: (1) Manual Muscle Testing (MMT) method to evaluate muscle strength; (2) joint angle ruler to assess joint range of motion (ROM); (3) passive joint activities to assess the muscle tension; (4) Modified Ashworth Score (MAS) to assess spasm; (5) balanced response to assess sitting balance and standing balance; (6) international generic Barthel Index Scale to evaluate ADL. Complications as related to rehabilitation were also recorded. Descriptive statistics were employed to describe the epidemiology, pattern of motor function loss and type of injuries. Results: The most common types of injuries in our sample of seismic wounded treated in ICU were: fracture (70%), nervous system injuries (20%), squeezing syndrome (5%) and pulmonary contusion (5%). The fracture proportion was higher in female than male (about 2:1). Amputation and paralysis occurred more in male than female (about 7:1 and 3:1 respectively). Lung infection as a complication in ICU stay was more common in female than male (4:1). We reported that most of the seismic wounded patient had early loss of motor function during the stay in ICU. Conclusion: Limited ROM, declined muscle strength, abnormal muscle tension, balance dysfunction, alteration of ADL capacity and lung infection are the main dysfunctions occurring among the seismic wounded in ICU ward. Loss of motor function can occur early and therefore active physiotherapy should start even during the stay in ICU. (Hong Kong j.emerg.med. 2011;18:86-91)
目的：描述地震中受傷的ICU病人的運動功能和日常生活活動能力（ADL），並提供地震傷員臨床康復治療的一些洞見。方法：前瞻性研究。經過培訓的評估人員，採用不同的常用測試方法，來測量在ICU治療的地震傷員的運動功能：(1) 徒手肌力測試（MMT）方法來評估肌肉力量；(2) 關節角度標尺來評估關節運動的範圍（ROM）；(3) 被動關節活動，以評估肌肉張力；(4) 運用改良Ashworth評分（MAS）來評估攣縮；(5) 平衡反應，以評估坐姿平衡和站立平衡；(6) 國際通用的Barthel指數量表，以評估ADL。同時記錄康復相關的併發症。並用描述性統計來描述傷員的流行病學：運動功能喪失的模式和傷害的類型。結果：在我們的地震傷員樣本中，最常見的傷害類型為：骨折(70%)、神經系統損傷(20%)、擠壓綜合徵(5%)和肺挫傷(5%)。骨折的比例，女性高於男性（約2:1）。截肢和癱瘓傷害的發生，男性高於女性（分別約7:1和3:1）。在ICU發生的肺部感染併發症，女性高於男性（4:1）。大多數在ICU留醫的地震傷員，喪失運動功能多發生在早期。結論：在ICU治療的地震傷員，主要的功能障礙為：ROM的受限、肌肉力量下降、肌肉張力異常、平衡功能障礙、日常生活能力受限和肺部感染。喪失運動功能會在早期發生，因此在ICU留醫期間，便應該開始積極的物理治療。

Keywords: Activities of daily living, disaster, self-cares (rehabilitation), wound and injury

關鍵詞：日常生活活動，災害，自我照顧（康復）, 創傷和損傷

Introduction

On May 12 2008, a grade 8 earthquake occurred in Wenchuan County, Sichuan Province of China. According to the Ministry of Civil Affairs report on July 13 2008, it was confirmed that 69,197 people died, 374,176 wounded, 18,289 people missed. It was also reported that the number of persons with major disabilities reached as many as 50,000. On July 5, 2008, we evaluated motor function and activities of daily living (ADL) capacity in a group of the seismic wounded patients treated in the intensive care unit (ICU) of the Sichuan University West China Hospital. We aimed to discuss their injury patterns, functional disabilities and clinical rehabilitation needs to throw light to the existing rehabilitation program.

Methods

All the Wenchuan seismic wounded patients treated in ICU ward of West China Hospital during the assessment period from 16 May 2008 to 20 May 2008 were included.

The main motor parameters of interest in this study were motor function, equilibrium function and ADL capacity of the wounded patients. We applied (1) Manual Muscle Testing (MMT) method to evaluate muscle strength; (2) joint angle ruler to assess joint range of motion (ROM); (3) passive joint activities to assess the muscle tension; (4) Modified Ashworth Score (MAS) to assess spasm; (5) balanced response to assess sitting balance and standing balance; (6) International generic version of Barthel Index Scale to evaluate ADL. The complications occurred during the stay in ICU as related to rehabilitation were also recorded.

In order to avoid interference and ensure the authenticity and reliability of the study, only professionally trained postgraduate students of rehabilitation were recruited to do the assessment. Adequate span of time (nearly 20 to 30 minutes) were ensured to provide a complete assessment for each wounded patient. Both the patients and assessing staff did not know the purpose of this investigation before the assessment (double-blind). All data input were double checked to avoid entry mistake.

Descriptive statistics were employed to show the characteristics of the wounded patients, the pattern of injuries and their types of functional loss. Differences between groups were compared with t-test or Fisher exact test. Significance level was taken at p=0.05.

Results

A total of 36 Wenchuan seismic wounded patients were treated in ICU ward of West China Hospital during
the study period. Effective assessment data were available in only 28 wounded patients (76%). Nine patients were in very critical condition which did not allow any motor assessment. Of the 28 assessed patients, ROM was measured in 21 (75%) only because 7 of them had mild coma or systemic multiple fractures. Strength was assessed in 15 (54%) patients only because the other 7 had mild coma, 4 were manic and 2 were not cooperative to do the assessment. Muscle tension was measured in 19 patients (68%) only because the other 7 had systemic multiple fractures and 2 were not cooperative to do the assessment. Sitting balance was assessed in 10 cases (36%) only because the other 18 cases had mild coma, lethargy, fractures or mania. Standing balance was measured in only 1 case because most of the patients (27) were unable to stand due to fractures or had coma or mania. ADL was assessed in 20 cases (71%). The rest of 7 cases were having mild coma, mania or uncooperative to the assessment (Figure 1).

The wounded ratio of male to female was 1:1.8. As seen in Figure 2, the main problems leading to ICU admission were fractures (70%), nervous system injuries (20%), crush syndrome (5%) and pulmonary contusion (5%). Some cases were admitted to ICU because of lung infection as a complication after surgical procedures like amputation, paralysis or prolonged immobilisation on bed.

As shown in Figure 2, more females suffered from fracture than males (11/23 and 3/13 respectively; 2-
tailed Fisher exact test, \( p=0.175 \)). More males suffered from nervous system damage than females (2/13 and 2/23 respectively; 2-tailed Fisher exact test, \( p=0.595 \)). For amputation, it was significantly higher in male than female (4/13 and 1/23 respectively; 2-tailed Fisher exact test, \( p=0.047 \)). For paralysis, it was higher in male than female (3/13 and 2/23 respectively; 2-tailed Fisher exact test, \( p=0.328 \)). Lung infection was more common in female than male (7/23 and 1/13 respectively; 2-tailed Fisher exact test, \( p=0.213 \)).

As seen in Table 1, the seismic wounded patients treated in ICU had major early motor and functional loss, and the prevalence of different types of loss were (1) restricted ROM (46.7%), (2) declined muscle strength (93.3%), (3) declined muscle tension (15.8%), (4) increased muscle tension (36.8%), (5) declined sitting balance (30%), (6) declined standing balance (96.4%), (7) restricted ADL capacity (100%); (8) lung infection (40%), (9) restricted joint ROM (47.6%), (10) declined muscle strength (93.3%).

As seen in Figure 3, 100% of cases had some extent of decrease in ADL capacity. All cases had restrictions in bathing, grooming, toilet, plain walking for 45 meters, and stair activity. About 95% had restriction in eating capacity, 90% had restriction in dressing capacity, 35% had faecal incontinence, 60% had declined urine control, 95% had reduced ability to transfer from bed to chair.

### Table 1. The motor function and equilibrium function

<table>
<thead>
<tr>
<th></th>
<th>ROM</th>
<th>Strength</th>
<th>Muscle tension</th>
<th>Sitting balance</th>
<th>Standing balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>11 (52.4%)</td>
<td>1 (6.7%)</td>
<td>9 (47.4%)</td>
<td>7 (70%)</td>
<td>1 (3.6%)</td>
</tr>
<tr>
<td>Weakened</td>
<td>10 (47.6%)</td>
<td>14 (93.3%)</td>
<td>3 (15.8%)</td>
<td>3 (30%)</td>
<td>27 (96.4%)</td>
</tr>
<tr>
<td>Increased</td>
<td>0</td>
<td>-</td>
<td>7 (36.8%)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>21</td>
<td>15</td>
<td>19</td>
<td>10</td>
<td>28</td>
</tr>
</tbody>
</table>

![Figure 3](image.png)
Discussion

Over 500,000 earthquakes were reported in the world each year, in which about 150,000 can be felt, 20 can cause serious damage. Only about 2 destructive earthquakes occur each year. An earthquake not only causes a large number of mortalities, but an even greater number of wounded people with residual permanent disabilities. Rehabilitation is very important to prevent secondary injury from complication, and to maximise the chance to regain functional ability loss due to the primary damage.

Most common types of wounding included fracture, head injury, multiple rib fractures and haemopneumothorax. In the earthquake which occurred in the city of Bam in Iran in December 2003, Emami reported that limb fractures (19%) were more common than the axial fractures (4%). Our study also revealed a similar pattern that fracture was the most common wounding and it accounted for 70% of cases in our study. Earthquake causes the buildings to collapse and the debris to flow, that can bury and press on the victims to cause musculoskeletal trauma.

As explained by the fact that only one patient could stand and the majority was bedridden, the seismic wounded patients treated in our ICU wards had a universal decline in motor function and muscle strength. There has been no relevant report on the relationship between earthquake and motor function and equilibrium function.

In this study, all the seismic wounded patients treated in ICU wards had decline in ADL capacity that seriously affected their daily life activities. The main reason was a primary damage to the locomotive or nervous system with, in some cases, further aggravation by complications such as chest infection, urinary tract infection, loss of muscle strength and decline in cardiac function. The effect of being bedridden and other complications was more prominent in female than male. So this might suggest that in case of limited manpower, more resources like chest physiotherapy to prevent chest infection should be reserved for female than male patients.

The seismic fractures occurred more in female victims but amputations and paralysis condition occurred more in male victims. Our possible postulation is: more female victims with severe limb fracture died and could not survive to admission when comparing to male counterpart who could be stronger, with larger physiological reserve.

The earthquake that occurred in Haiti on 12 January 2010 resulted in massive infrastructure damage, and created one of the largest single-day losses in modern history. Landry share the experience of working in post-earthquake Haiti, and highlighted the critical importance of providing rehabilitation services during and after a humanitarian crisis of this magnitude.

Early rehabilitation for the injured is very important after the earthquake. Most of the victims’ motion functions have been severely damaged. When vital signs have become stable, one should start rehabilitation immediately. Majority of people believe that rehabilitation is a treatment after stabilisation and it is not suitable to start rehabilitation in the early time such as during ICU stay. However, this study demonstrated that the wounded in ICU had shown early impairment and loss of motor function, and therefore early rehabilitation should be considered for wounded patients even during ICU stay. Besides, chest physiotherapy, early rehabilitation intervention should be targeted to maintain and improve ROM. Strength training, tension reducing (e.g. drawing training), balance training, respiratory training, stand and walk training and ADL training are basic but effective rehabilitation therapies.

Owing to time constraints, there were some deficiencies in this study. Firstly, the wounded in ICU ward were more severe patients and may not represent the situation of patients in general ward. Secondly, not all
ICU patients were recruited and there was data loss because some patients were still in a coma or even a manic state rendering them not suitable to be assessed or could not complete the assessment.

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References