Respiratory Complication of Tsunami Victims in Phuket and Phang-Nga

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In the present report the authors describe the clinical and laboratory findings of 26 tsunami victims admitted to the Phuket and the Takua Pa Hospital. Patients were classified into 4 groups of severity: class 1, baseline examination negative (n = 1); class 2, baseline examination positive but mechanical ventilation not needed on admission (n = 15); class 3, mechanical ventilation required on admission (n = 9); class 4, cardiopulmonary arrest (n = 1). On admission, 21/23 patients had fever of > 37.5 C. 3/10 patients had hypernatremia and 7/10 cases had metabolic acidosis.

The radiological manifestation varied from focal disease to diffuse infiltrations, either reticulonodular or patchy lesions. There were 3 clinical courses among diffuse diseases: 1) diffuse infiltrations and progression 3 cases 2) diffuse infiltration, early regression followed by progression 2 cases 3) diffuse infiltration and steady regression 5 cases.

Late complications comprised of pneumothorax/pneumomediastinum (n = 5) and bacterial pneumonia (n = 18). The authors got culture data in 9 patients, most of them were infected with aerobic gram -ve bacteria and 2 of them were B. pseudomallei. The prognosis in the tsunami related medical illness was favorable. Only 2 patients (7.7%) died in the present study.

Keywords: *Tsunami, Seawater near-drowning, Pulmonary edema, B. pseudomallei*

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On December 26, 2004, an earthquake triggered a devastating tsunami that caused more than 300,000 deaths in eight countries on two continents. The disaster prompted extraordinary nationwide and international attention and support[1]. The authors were one of the medical teams from Rajavithi Hospital, Thai Ministry of Public Health. The authors arrived in Phuket and Takua Pa on December 30, and spent 2 weeks there taking care of the patients. Despite the short period of time and limited experience, it is hoped that this report might provide some information to re-establish a casualty plan and medical facilities concerning tsunami related illnesses.

Material and Method

Tsunami victims admitted to Phuket Hospital (on the 5th day) and Takua Pa Hospital (on the 6th day) were screened for respiratory illness such as cough, breathlessness, and respiratory failure. Those patients who still had respiratory symptoms were included in the present study and the clinical and laboratory findings on admission were reviewed. They were then categorized into 2 groups. 1) Likely pneumonia, characterized by fever and/or respiratory illness plus one of the radiological features: new infiltration, worsening of pre-existing lesion, or not improving/ relatively delayed resolving of focal area of infiltration. 2) Pneumonia was not likely. Patients in the "likely pneumonia" group were aggressively treated with broad spectrum (including anti-pseudomonas) antibiotics. The remaining patients were managed as usual.

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Results

Clinical manifestation

26 tsunami victims were included in the present study. There were 10 males and 16 females,

aged 9-70 years. 23 patients were Thai and the other 3 patients were foreigners. The severity[2] on admission was classified as shown in Table 1.

On admission, chest film was taken in all patients, vital signs reported in 23 patients and blood chemistry in 10. The authors found that 1) 21/23 patients had fever of > 37.5°C and surprisingly the fever subsided gradually at the end of the first week in many patients (Fig. 1). 2) 10/26 cases had respiratory failure and required mechanical ventilation. 3) 24/26 patients had infiltrates on chest film could be due to aspiration. 4) 3/10 patients had hypernatremia, serum Na > 145 meq/L and 5) 7/10 patients had metabolic acidosis, serum HCO_3 < 20 meq/L.

Table 2 describes the chest film on admission. 14 patients had focal disease, 10 patients had diffuse infiltrations. There were 3 different clinical courses among the diffuse disease: 1) diffuse infiltration and progression (n = 3, Fig. 2), 2) diffuse infiltration, early regression followed by progression (n = 2, Fig. 3), 3) diffuse infiltration and steady regression (n = 5, Fig. 4). The other 2 patients had no active lesion on admission, but pulmonary complication developed later during hospitalization.

Complications

All patients survived the first peak crisis, but late complications and mortality resulted as follows: 1) pneumothorax and/or pneumomediastinum (n = 5, 19.2%), 2) likely pneumonia (n = 18, 69.2%), 3) acute renal failure (n = 2, 7.7%), 4) volume overload (surgery under spinal block: n = 1, 3.8%), 5) worsening of respiratory function (n = 5, 19.2%) and 6) death (n = 2, 7.7%).

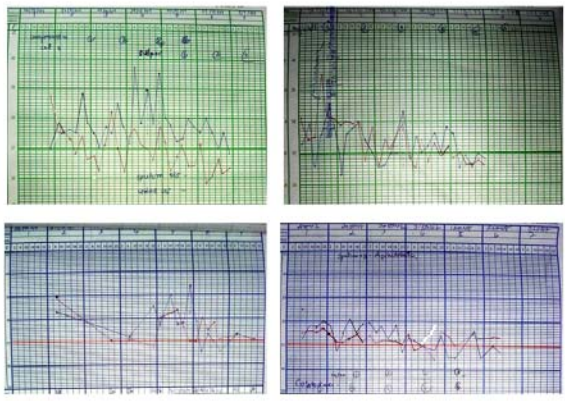

Fig. 1 Fever on admission and gradually subsided within one week

Pneumonia

There were 18 cases (69.2%) who met the defined criteria. One patient was transferred back to their home country a few hours after starting antibiotics. The authors got culture data either from the sputum or blood in 9 patients (Table 3), two of them were acute pulmonary infection of Burkholderia pseudomallei (Fig. 5).

Outcomes

Most patients were successfully treated and saved. There were 2 deaths in the likely pneumonia group (11.8%). They were classified as class 3 and

Table 1. Severity classification on admission

Severity	Number
Class 1: baseline examination negative on admission	1
Class 2: baseline examination positive*, ventilator not needed	15
Class 3: mechanical ventilation required on admission	9
Class 4: cardiopulmonary arrest on admission	1

* depressed consciousness, tachypnea, or abnormal chest auscultation

Table 2. Radiological manifestation on admission and outcome

Radiological manifestation	Survived	Died
Normal	2	-
Diffuse infiltration and progression	3	-
Diffuse infiltration, early regression followed by progression	-	2
Diffuse infiltration and steady regression	5	-
Focal disease	14	-
Total	24	2

Table 3. Bacteriology (more than one pathogen reported in one patient)

Specimen	Pathogen	Number
Sputum	• Ps. aeruginosa	4
	• E. coli	1
	• K. pneumoniae	1
	• Acinetobacter	3
	• B. pseudomallei	2
	• S. aureus coagulase -ve	1
	• Candida	1
Blood	• K. pneumoniae	1
	• B. pseudomallei	1

Fig. 2 Diffuse infiltration and progression

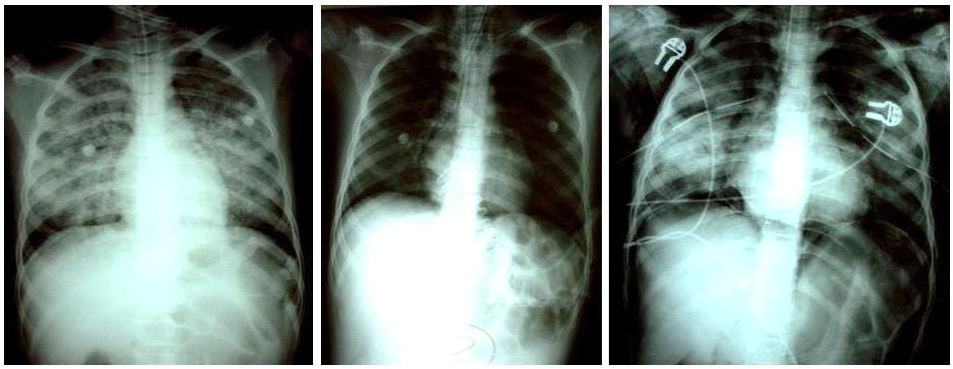

Fig. 3 Diffuse infiltration, early regression followed by progression

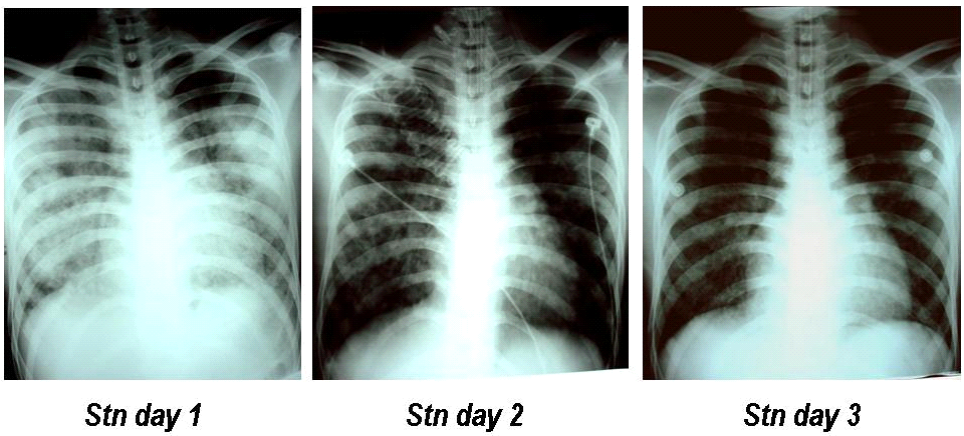

Fig. 4 Diffuse infiltration and steady regression

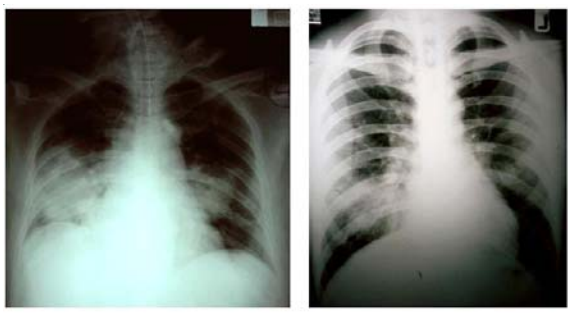

Fig. 5 Two cases of melioidosis

class 4 in severity. The class specific mortality rate was 11.1% and 100% respectively, and the overall mortality rate was 7.7%. Table 4 shows the outcomes according to severity and culture data.

Discussion

This catastrophe was unusually vast, and the authors had had no experience in such a disaster before and had to learn more in order to re-establish more effective casualty plan and medical facilities. Most patients reported in the present study were classified as class 2 and 3 (moderate to severe) in severity. It could be related to submersion duration and the amount of aspirated water. The aspiration of seawater, which was strongly hypertonic with respect to plasma, resulted in pulmonary edema, both from the quantity of aspirated seawater and the osmotically driven ultrafiltrate of plasma that accumulated in the air spaces. The most important consequences were hypoxia and its effects on the cardiovascular system and the CNS. Initially the alveolar cells and barrier function were well-preserved[3], the excess alveolar fluid was reabsorbed very rapidly[4], as shown by much clearing of lung infiltrates within one day. The stability of lung surfactant phospholipids was progressive decrease from 48 h until 96 h[5], resulted in permeability pulmonary edema in the following days.

Aspirating contaminated seawater, submersion victims were likely to develop on top bacterial pneumonia. But it was difficult to differentiate pneumonia and the aspiration as it was neither related to body temperature[2], respiratory symptom nor radiological manifestation on admission. Although virulence aerobic gram -ve bacteria and B. pseudomallei[6] were reported, the pathogens were susceptible to most common antibiotics and the outcomes were favorable.

No patient presented with hypothermia as described in another study[7]. It could be due to differences in climate and severity. Unfortunately, the 2 patients complicated with acute renal failure and 3 patients with hypernatremia had not been investigated. It was mentioned elsewhere[8-10] that rhabdomyolysis could be the cause of acute renal failure.

Five patients with pneumothorax and/or pneumomediastinum were associated with barotraumas during mechanical ventilation and PEEP. Causing more difficulty in patient management, it contributed in both of the dead cases. Other features for deaths in the present study were high fever and respiratory failure on admission, class 3 and 4 in severity, diffuse infiltrations with early regression and then progression, and the low serum HCO_3 <15 meq/L. Contradictory patients who had diffuse infiltrations with steady regression or focal disease carried favorable prognosis, despite mechanical ventilation on admission.

Table 4. Outcomes according to severity and culture data

Severity	Culture data	Survived	Died
Class 1	-	1	-
Class 2	Ps. aeruginosa Acinetobacter E. coli K. pneumoniae B. pseudomallei Candida	15	-
Class 3	Ps. aeruginosa Acinetobacter K. pneumoniae B. pseudomallei S. aureus coagulase -ve	8	1 (11.1%)
Class 4	-	-	1 (100%)
Total		24	2 (7.7%)

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ภาวะแทรกซ้อนทางระบบการหายใจจากสึนามิ

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รายงานข้อมูลทางคลินิกของผู้ประสบภัยคลื่นยักษ์สึนามิที่นอนรักษาตัวในโรงพยาบาลวชิระภูเก็ต และโรงพยาบาลตะกั่วป่า จำนวน 26 ราย จำแนกความรุนแรงแรกรับเป็น 1) ไม่พบความผิดปกติ 1 ราย 2) พบความผิดปกติ แต่ไม่ต้องใช้เครื่องช่วยหายใจ 15 ราย 3) ต้องใช้เครื่องช่วยหายใจ 9 ราย 4) ต้องกู้ชีวิต 1 ราย ผู้ป่วย 21/23 รายมีไข้มากกว่า 37.5°C ตั้งแต่วันแรกของเหตุการณ์ ผู้ป่วย 3/10 ราย มีภาวะเกลือโซเดียมสูง และ 7/10 ราย มีภาวะเลือดเป็นกรด

ภาพรังสีทรวงอกพบรอยโรคทั้งแบบกระจาย และแบบเฉพาะที่ ผู้ป่วยที่มีรอยโรคแบบกระจาย มีการดำเนินโรคเป็น 3 ลักษณะคือ 1) รอยโรคเป็นมากขึ้นต่อเนื่อง 3 ราย 2) รอยโรคดีขึ้นในวันที่สอง และกลับเลวลง 2 ราย 3) รอยโรคดีขึ้นต่อเนื่อง 5 ราย ผู้ป่วย 14 รายมีรอยโรคแบบเฉพาะที่ และอีก 2 ราย มีภาพรังสีทรวงอกปกติในวันแรก แต่เกิดภาวะแทรกซ้อนในภายหลัง

หลังจากช่วงวิกฤต พบภาวะแทรกซ้อนที่สำคัญคือ 1) ถุงลมปอดรั่ว 5 ราย 2) ปอดบวม 18 ราย ซึ่งสามารถระบุเชื้อโรคที่อาจเป็นสาเหตุได้ จากการเพาะเชื้อในเสมหะและในเลือด 9 ราย พบเชื้อต่าง ๆ โดยเฉพาะเชื้อแบคทีเรียกรัมลบ 7 ราย และเชื้อ B. pseudomallei 2 ราย ผู้ป่วยส่วนใหญ่ตอบสนองต่อการรักษาดี มีผู้ป่วยที่เสียชีวิตในการศึกษานี้เพียง 2 รายหรือคิดเป็น 7.7%