

## Emergency physicians in tsunami relief: a discussion of tsunami-related health conditions and necessary preparations

海嘯救援中的急症科醫生：討論有關海嘯的衛生狀況及所需的籌備

JSH Chung 鍾舜恆, KC Shek 石錦全, HH Yau 游漢雄, CW Kam 甘澤華

---

The Indian Ocean tsunami on 26th December 2004 had prompted extensive humanitarian responses and many emergency physicians had offered to join the relief force. This article discusses tsunami-related health conditions including trauma, infectious diseases and mental disturbance and how emergency physicians should be prepared in terms of emotional stability and alertness, medical protection and equipments before shouldering the responsibility. (*Hong Kong j.emerg.med.* 2005;12:252-260)

二零零四年十二月二十六日印度洋的海嘯，推動了廣泛的人道救援。有很多急症科醫生曾試圖加入救援隊伍。本文討論有關海嘯的衛生狀況，包括創傷、傳染病與精神病態，與及急症科醫生在肩負責任前應如何就情緒的穩定、警覺性、醫療保險範圍及裝備上作準備。

**Keywords:** Emergency medicine, infection, mental health, natural disaster, wounds and injuries

**關鍵詞：**急症醫學、感染、精神健康、自然災難、傷口及創傷

### Introduction

On 26th December 2004 (00:08 hour, GMT), an undersea earthquake of a magnitude of 8.9 (Richter scale) occurred off the west coast of Northern Sumatra. In the hours and days that followed, numerous aftershocks of magnitude of 5.0 or above were reported. The largest and most destructive aftermath was the tsunami that struck the coast of the Indian Ocean. It took away more than 160,000 lives and caused enormous property damage and economic loss.

After a tsunami hit or other catastrophes, emergency care is of prime importance and so are emergency physicians who possess the relevant knowledge and experience. This article aims to provide a comprehensive list of probable health conditions and a reference for medical assessment.

### The birth of a tsunami<sup>1</sup>

The term "tsunami" comes from the Japanese words "tsu"/ 津 which means harbour and "nami"/ 波 / 浪 which means waves. The name was first given by a group of fishermen who narrowly escaped a tsunami. They were unaware of any wave in the open water when the tsunami happened, but when they returned to the port they found the area had already been devastated by unusually large waves. This is typical of a tsunami, which has a smaller wave height offshore and a very huge wave height (often hundreds of kilometres) near-

---

Correspondence to:

Chung Shun Hang, Joseph, MBChB, FRCSEd, FHKCEM  
Tuen Mun Hospital, Accident & Emergency Department, Tsing  
Chung Koon Road, Tuen Mun, N.T., Hong Kong  
Email: drchung@netvigator.com

Shek Kam Chuen, MBBS, FRCSEd, FHKCEM  
Yau Hon Hung, FRCSEd, FFAEM, FHKCEM  
Kam Chak Wah, MRCP(UK), FRCSEd, FHKCEM

shore. For this reason, while a tsunami forms violent tides approaching the coasts, they generally pass unnoticed as only a passing "hump" in the ocean.

The commonest cause of tsunamis is underwater earthquake. Other causes include landslides, volcanic eruption and the impact of extra-terrestrial bodies such as meteorites. The theory of plate tectonics suggests that the outer layer of the Earth (lithosphere) is broken into seven huge plates that are constantly in motion. These tectonic plates can move towards, away or along each other. Along the fault lines are where the most dramatic movements occur, resulting in earthquakes and tsunamis if the earthquakes take place under sea level.

At the plate boundary where two tectonic plates come into contact, a heavier plate can slip under a lighter one. This phenomenon is called subduction. In some cases of subduction, the weight of the sinking plate might cause the part of the seafloor connected to the lighter plate to "snap up" and result in an earthquake. The origin of the earthquake is the point within the Earth where the first rupture occurs and the first seismic waves are generated. When the energy of such force is transferred to the water, the water will be pushed upward above normal sea level. Gravity will then act on the water, dispersing the energy horizontally and creating huge waves that travel toward the shore. This is how a tsunami is formed.

## **Tsunami-related health conditions**

Emergency physicians at tsunami-affected areas will encounter a vast volume of patients because the catastrophe does not only cause negative impacts on the victims but also adversely affect the victims' friends and families, witnesses of the catastrophe and sometimes even relief workers themselves.

Tsunami-related health conditions can be classified into three groups, namely, trauma, infectious diseases and mental disturbance.

### ***Drowning and trauma***

Tsunami victims may suffer from near-drowning due to, however temporarily, the inhalation of seawater. Seawater can pull fluid into the lung from the bloodstream, causing pulmonary oedema (wet drowning). Some victims may present with the clinical features of upper airway obstruction secondary to reflexive laryngospasm (dry drowning). Near-drowning is also associated with hypothermia, cervical spine injury, secondary pulmonary infection and acute tubular necrosis.

The victims might also suffer from head and limb injuries when they are washed by the tidal wave into houses, trees or any stationary objects. Possible conditions include dirty lacerations, penetrating joint injuries, closed or open limb fractures.<sup>2</sup>

### ***Infectious diseases<sup>3</sup>***

After a tsunami, relief agencies would always warn of the possibility of more deaths to come as a result of the subsequent wave of epidemics. These diseases, caused by poor sanitation and unburied dead bodies, might come in days to weeks after the initial catastrophe.

The tidal wave will have destroyed the sanitation system and contaminated the existing food and clean-water supply.<sup>4,5</sup> However, the survivors, facing extreme hunger and thirst, will have no choice but to consume the contaminated food and water. It will increase the likelihood of food and water-borne diseases, such as cholera, enteric fever, shigellosis, hepatitis A and E.

Furthermore, the remaining flooding and stagnant seawater, when diluted by fresh or rain water, will create a favourable environment for mosquito breeding. Thus, the incidence of mosquito-borne diseases will surge, e.g. malaria, dengue fever and Japanese encephalitis. These diseases, in fact, will also pose serious threat to the relief workers, who are probably not immune.

The patients infected may present with fever, fever with rash, diarrhoea, jaundice, respiratory symptoms,

central nervous system symptoms, skin or wound infection.<sup>6</sup>

### **Fever**

Fever is common in malaria and enteric fever. Other potential causes of fever include leptospirosis, Hantavirus infection, dengue, Japanese encephalitis, rickettsioses, melioidosis and plague.

### *Malaria*

It is already an endemic disease in most countries affected by this tsunami. Malaria, with an incubation period of at least seven days, may present with symptoms of non-specific flu-like symptoms: headache, malaise, myalgia, anorexia and later chills and fever. It may also present with signs of pallor, jaundice or hepato-splenomegaly. Urgent peripheral blood smears (thick and thin) for Giemsa-stain are essential for its diagnosis in emergency operations.

### *Enteric fever (typhoid and paratyphoid fever)*<sup>7</sup>

Enteric fever, a group of febrile illness associated with enteric symptoms, can be caused by *Salmonella typhi* (the commonest), *Salmonella paratyphi* A, B or C, or occasionally *Salmonella typhimurium*. It is a disease often found in developing countries, such as India, Southeast Asia and Africa, where the sanitary systems are poor. The patients will present with a wide range of manifestations that change with time. Apart from fever, they may present with symptoms including headache and constipation, to be followed by diarrhoea, confusion, and other features. They may also show signs of pulse-temperature deficit, rose-spots and splenomegaly. Blood culture is useful for diagnosis in the first two weeks of the illness. Stool and urine cultures are also helpful after the first week of fever. Widal's test has limited value because its sensitivity, specificity, and predictive values vary dramatically from laboratory to laboratory.

### *Leptospirosis*<sup>8</sup>

A worldwide water-related disease, leptospirosis occurs in both rural and urban areas and in tropical and temperate climate. It is a zoonotic disease caused by the *Leptospira interrogans* complex (spirochetes). Tsunami victims and relief workers who are exposed

extensively to water, which is likely to be contaminated with the infected urine of hosts like rodents may be infected through skin abrasions or intact mucous membranes. After an incubation period 2-30 days (usually 5-14 days), the patients will present with an abrupt onset of fever, chills, headache and myalgia. They may also show signs of conjunctival suffusion, jaundice or muscle tenderness over the calf and lumbar areas. It can be diagnosed by blood culture (within the first 10 days of illness), urine culture (after the second to fourth weeks) or serological tests (during the second week of the infection).

### *Hantavirus infection*<sup>9</sup>

Rodents infected with this virus can be found in some parts of Thailand. Victims can contract the disease due to exposure to water contaminated by urine, faeces or saliva from infected rodents. The patients may present the clinical picture of "haemorrhagic fever with renal syndrome". They may have fever, myalgia, facial flushing, petechiae over the palate and trunk, conjunctival injection, proteinuria, other haemorrhagic manifestations, renal failure or hypotension. The diagnosis can be confirmed by serology test, which is routinely available in the Government Virus Unit of Queen Mary Hospital.

### *Dengue*<sup>10</sup>

It is an endemic disease found in most countries affected by this tsunami (except Maldives). With an incubation period of 3-14 days, persons bitten by mosquitoes (most commonly *Aedes aegypti*) infected by Flavivirus DEN-1,2,3,4 will present with fever, headache, retro-orbital pain, musculoskeletal pain and skin rash. They may be complicated by dengue haemorrhagic fever or dengue shock syndrome. They can be diagnosed by positive IgM serology or antibody titre of  $\geq 1,280$  to dengue fever.

### *Japanese encephalitis*<sup>11</sup>

It is an endemic disease with seasonal distribution in many Asian countries such as Thailand, Indonesia, Sri Lanka, India and Malaysia. With an incubation period of 5-15 days, a small proportion (300:1) of persons bitten by the mosquito (mainly *Culex tritaeniorhynchus*) will present with febrile headache or aseptic meningitis.

Some of them will even deteriorate to stupor, disorientation, coma, paralysis, psychosis or convulsion. It is mainly diagnosed by serology (4-fold changes of antibody titre in acute and convalescent serum by haemagglutination inhibition test).

#### *Rickettsioses*

It is caused by a group of obligate intracellular bacteria that are transmitted to man by their arthropod hosts (e.g. tick, mite) and that invade the cells of blood vessels. The affected patients may present with murine typhus, scrub typhus or spotted fever. They are diagnosed mainly by serology.

#### *Melioidosis*<sup>12</sup>

It is an endemic disease found in Southeast Asia and is especially widespread in Thailand. By 24th January 2005, there were two suspected cases of melioidosis under investigation in Indonesia. It is caused by the bacteria *Burkholderia pseudomallei* and transmitted to humans through direct skin contact with contaminated soil or water. Ingestion of contaminated water and inhalation of dust contaminated with the organism are other mechanisms of transmission. It may present as localised abscess formation, pneumonia or highly fatal septicaemia. It can be diagnosed by serology, i.e. 4-fold increase in the titre for melioidosis.

#### *Plague*<sup>13</sup>

As one of the oldest identifiable diseases known to man, plague remains endemic in many natural foci around the world. It has been reported in India and many East African countries such as Madagascar, Mozambique and Tanzania. It can be contracted by bites of infected flea from an infected rodent. For bubonic plague, they may present with sudden onset of fever with acutely swollen tender lymph nodes. It carries a mortality of 14%. Other presentations include septicaemic plague and pneumonic plague.

#### **Fever with rash**

As outbreaks of meningococcal meningitis occur from time to time, the possibility of meningococcaemia should be carefully considered for patients presenting with fever and rash. The likelihood of meningococcaemia increases if the patient has recently travelled from the

"meningitis belt" in Africa (a region of savannah that extends from Ethiopia in East Africa to Senegal in West Africa).<sup>14</sup> Typhoid fever, leptospirosis, rickettsioses, dengue, viral haemorrhagic fever and septicaemic plague should also be considered possible diagnoses.

In the case of meningococcaemia, the rash is characteristically petechial, small and irregular with "smudged" appearance, and is often raised with pale greyish vesicular centres. It is commonly located on the extremities and the trunk.<sup>15</sup>

In the case of typhoid fever, the rose spots will appear as slightly raised, non-tender, pink papules that blanch on pressure. They usually appear in crops of 10 to 20 lesions and are often located between the nipple area and the umbilicus on the anterior trunk.

In the case of leptospirosis, skin lesions usually appear on the trunk and take the form of macules, papules, urticaria and petechiae.<sup>16</sup>

In the case of dengue, skin eruptions appear in 80% of patients during the remission of fever. They may appear as centrifugal macular, maculopapular, scarlatiniform or petechial eruptions. The eruptions may become confluent with small round islands of sparing, the so-called white islands in a sea of red. The rash characteristically starts on the dorsum of hands and feet and spreads to the arms, legs, and torso, while the face is relatively spared. The eruption seen in dengue lasts two hours to several days.<sup>9</sup>

Viral haemorrhagic fever is an acute illness due to infection by four viral families: Arenaviridae, Bunyviridae, Filoviridae and Flaviviridae. They fall in the same group because of the common underlying pathophysiology. They all attack the vascular bed with resultant microvascular damage and changes in vascular permeability. They are usually transmitted by contact with the natural reservoirs, e.g. mosquitoes, ticks, or rodents. Flaviviridae can be found in the entire tropical zone, including India and Southeast Asia.<sup>17</sup>

For patients with septicaemic plague, they may present with purpuric skin lesions, together with gangrene of acral regions leading to "Black Death".<sup>13</sup>

### **Diarrhoea**

Sporadic cases of diarrhoea have been reported in the tsunami-affected countries, such as Thailand. Important pathogens for consideration include enterotoxigenic *Escherichia coli* (ETEC), *Shigella*, *Salmonella*, *Campylobacter*, *Vibrio cholerae*, *Giardia*, *Entamoeba histolytica*, *Cryptosporidium* and viruses.

### **Jaundice**

When a patient presents with jaundice, we should consider the diagnosis of hepatitis (A, B, C, E). Diagnoses like typhoid fever, leptospirosis and malaria should also be considered.

Hepatitis E has many similarities with hepatitis A. It is spread by the faecal-oral route with an incubation period of 3-8 weeks. Though worldwide distributed, it is predominant in tropical area where sanitation is inadequate and personal hygiene poor. Outbreaks are associated with rainy seasons, floods and overcrowding. Its overall mortality rate is 4%, but it carries a much higher mortality rate of 20% in pregnant women. Reported causes of death include encephalopathy and disseminated intravascular coagulation.

### **Respiratory symptoms**

Given the confirmed human cases of avian influenza in countries including Thailand, the possibility of such diseases should be carefully considered if a patient presents flu-like symptoms.

For patients with pneumonic plague, they may present with fever, cough, chest pain, dyspnoea, cyanosis and haemoptysis. Chest X-ray may show evidence of bronchopneumonia.

### **Central nervous system symptoms**

Neurological symptoms such as headache and convulsion may be the presentation of an underlying infection in patients in the affected countries.

#### *Japanese encephalitis*

For patients infected by Japanese encephalitis, they may have headache, tremor or convulsion. Furthermore, they may have meningeal signs, stupor, disorientation, coma and spastic paralysis.

#### *Rabies<sup>18</sup>*

The World Health Organization has reported that most of the annual 55,000 deaths from rabies happen in Asia and Africa. Patients with a history of mammal bite may present with fever, headache, anorexia, pain or paraesthesia at the site of bite or scratch in the prodromal phase. They may later deteriorate to hyperactivity, aphasia, paralysis and coma.

#### *Tetanus<sup>19</sup>*

It is an acute, often fatal disease caused by wound contamination with *Clostridium tetani*. With an incubation period of less than 24 hours to longer than one month, it can clinically present as local or generalised form. Local tetanus presents as persistent rigidity of muscles near the site of injury and usually resolves after weeks to months without sequelae. For generalised tetanus, it presents with generalised muscular rigidity, violent muscular contractions and instability of the autonomic nervous system. Management includes wound debridement, treatment of its complications (e.g. muscle relaxants, labetalol, antibiotics) and immunisation. History of receiving a full tetanus toxoid course should be enquired. Passive immunisation with human tetanus immune globulin should be considered for patients with a tetanus prone wound and unknown (or >10 years) tetanus toxoid status.

### **Skin infection**

Patients from the tsunami-affected areas may have also contracted pyoderms, dermatophytoses, scabies or cutaneous larva migrant.

### **Wound infection**

Infected wounds that do not respond to standard therapies, such as wound dressing and antibiotics, should lead to the consideration of possible infections of deeper structures such as the bones and joints. Wound caused by animal bites such as mammal and snake may present as persistent wound infection, which requires antibiotics with a broader spectrum of coverage (e.g. amoxicillin-clavulanate or ampicillin-sulbactam).

When treating patients with infected wounds sustained in or around water, the possibility of infections due to

Vibrionaceae (e.g. *Vibrio*, *Aeromonas*) or *Pseudomonas* should be considered.

In the case of *Vibrio* wound infection, the wound, after a short incubation period of 3-24 hours, may deteriorate rapidly with progressive wound swelling and severe pain. In patients with medical conditions such as cirrhosis or malignancies, the wound infection may progress even more rapidly, forming haemorrhagic bullae and extensive soft tissue necrosis. They may need surgical debridement and broader spectrum of antibiotic coverage (e.g. third generation cephalosporins, fluoroquinolones).

### ***Mental disturbance***

In this information age, the impact of the tsunami on human mental health is not limited to the victims and the relief workers who are physically present at the affected areas but also those who witness the occurrence of the catastrophe and its aftermaths through different media such as television, newspaper and the Internet. Also in the case of a tsunami, although some victims have been found dead, many have gone missing. This would delay the grief process of people who still have hopes of finding their loved ones.

The psychological impact can last as long as months or years and can be categorised into grief, acute stress disorder or post-traumatic disorder.

### **Grief reaction and abnormal grief**<sup>20</sup>

Grief is normally a continuous process that can be divided into three stages. The first stage lasts from a few hours to several days. The victim (whose loved one might have died or gone missing) presents the predominant feature of denial, which is manifested as a lack of emotional response (numbness). S/he often has a feeling of unreality and incomplete acceptance that the death has taken place. The victim may be restless, searching for the dead or missing person.

The second stage usually lasts for a few weeks to about half a year. The patient may experience extreme sadness, weeping, loneliness, and often overwhelming waves of yearning for the dead person. The bereaved person is anxious, restless, sleeps poorly, lacks appetite

and may experience panic attacks. Many victims, especially those who have tried to save the deceased but failed, will feel guilty of not trying hard enough. Some may have anger and project their feelings of guilt by blaming others for failing to provide optimal care for the dead person. Some victims may have vivid experience of being in the presence of the dead person. The bereaved person may have preoccupied memories of the dead person, sometimes in the form of intrusive images. Social withdrawal and complaints of physical symptoms are common.

During the third stage of grief, the above symptoms will subside and everyday activities will resume. The bereaved person starts to accept the loss and recalls the good times shared with the deceased in the past.

In the case of abnormal or pathological grief, the clinical picture may be characterised by one of the following features. First, the symptoms are more intense than usual and meet the criteria for a depressive disorder. Second, the symptoms are prolonged and last for more than six months. Third, the symptoms can be delayed in surfacing.

### **Acute stress disorder (DSM IV) or acute stress reaction (ICD10)**<sup>21</sup>

Acute stress reaction is a brief response, lasting from several hours to about three days, to severely stressful event. Acute stress disorder is a more prolonged response lasting from at least two days to at most four weeks.

The patient with acute stress disorder will present with anxiety, dissociative and other symptoms that occur within one month after the exposure to an extremely traumatic stressor.

The dissociative symptoms include a subjective sense of numbing, detachment, or an absence of emotional responsiveness, a reduction in awareness of his or her surroundings, derealisation, depersonalisation or dissociative amnesia.

Furthermore, the traumatic event is persistently re-experienced, and the patient displays marked avoidance

of stimuli that arouse recollections of the trauma. S/he also shows marked symptoms of anxiety or increased arousal. These symptoms may cause clinically significant distress, significantly interfere with normal functioning, or impair the individual's ability to pursue necessary tasks. The symptoms cannot be accounted for by direct physiological effects of a substance, general medical condition, brief psychotic disorder or an exacerbation of a pre-existing mental disorder.

### **Post-traumatic stress disorder**<sup>21</sup>

This is an intense, prolonged and sometimes delayed reaction to an intensely stressful event. The core features include hyperarousal, re-experiencing the images of the stressful events, and avoidance of reminders.

The traumatic events usually involve actual or threatened death or serious injury, or a threat to the physical integrity of self or others. The patient would respond with intense fear, helplessness, or horror.

The patient would present two of these hyperarousal symptoms: difficulty in falling asleep, irritability or outbursts of anger, difficulty in concentrating, hypervigilance or exaggerated startle response.

The patient might also avoid any stimulus associated with the trauma and numbing of general responsiveness. The symptoms of avoidance would include at least three of the followings: -

- i) Effort to avoid thoughts, feelings or conversations associated with the trauma;
- ii) Effort to avoid activities, places, or people that arouse recollections of the trauma;
- iii) Inability to recall an important aspect of trauma;
- iv) Markedly diminished interest or participation in significant activities;
- v) Feeling of detachment or estrangement from others;
- vi) Restricted range of affection (e.g. unable to have love feelings);
- vii) A sense of a foreshortened future (e.g. no expectation of a career, marriage, children, or a normal life span).

Symptoms of re-experience of the stressful events can be manifested in one of the following ways: -

- i) Recurrent and intrusive distressing recollections of the event, including images, thoughts, or perceptions.
- ii) Recurrent distressing dreams of the event.
- iii) Acting or feeling as if the traumatic event is recurring (including a sense of reliving the experience, illusions, hallucinations, and dissociative flashback episodes.
- iv) Intense psychological distress at exposure to internal or external cues that symbolise or resemble an aspect of the traumatic event.
- v) Physiological reactivity on exposure to internal or external cues that symbolise or resemble an aspect of the traumatic event.

### **Preparing to be a tsunami relief emergency physician**

As a member of the disaster support team, the emergency physician should ensure that he or she is carefully and thoroughly prepared before leaving for the tsunami-affected areas. The objectives are to protect personal safety and to avoid becoming a burden to other humanitarian personnel.

#### ***Be emotionally prepared and to stay alert***

The most basic preparation to weather the emotional challenge is to collect as much information about the affected areas as possible. The environment will be vastly different from a normal hospital and clinic. We should be prepared to work in a place with no electricity, safe water or food distribution system and be aware of the risks of sustaining illnesses and injuries. Extra alertness and caution are necessary. In areas with prior conflicts such as Sri Lanka, mines can be displaced by the tidal waves and the sign boards of known mine fields may be washed away.<sup>6</sup> Chaos might develop after the catastrophe, giving rise to security problems such as looting. An emergency plan in the event of a mishap is also necessary.

#### ***Be protected from infectious diseases***

Relief workers have a high risk (chances are they are

much less immune than the locals) of contracting various infectious diseases due to the non-existence of or damage to the sanitation system. It is therefore very important to be informed of the actual situation of the destination and to receive adequate vaccinations. In this connection, counselling and vaccination services from the Port Health Office (Travel Health Centres) will be very useful. For the tsunami-hit areas, vaccinations such as hepatitis A, B, Japanese encephalitis, rabies, typhoid fever, tetanus (booster dose) and cholera should be considered.<sup>22</sup> As for malaria prophylaxis, since most of the affected areas lie in the zone known to have chloroquine-resistance, we should turn to the chloroquine-resistant regimen, such as mefloquine, doxycycline, atovaquone plus proguanil, chloroquine phosphate plus proguanil or primaquine.<sup>23</sup>

### ***Bring along sufficient supplies and equipment***<sup>24</sup>

Essential supplies are usually provided by the organising institution and/or the government. However, it is still the emergency physician's responsibility to bring an optimal amount of essential supplies. The following is an extended checklist of items, which are grouped into six categories: food and water, toiletries, clothing, outdoor gears, security items and comfort objects. To ensure orderly packing, we should divide the luggage into these groups.

We should ensure that only adequately boiled water is consumed as far as possible. On the other hand, it is necessary to bring some bottled water, water filter, purification system or water purification tablets. Non-perishable food items should also be packed to ensure the adequate supply of rations in case of emergency.

As for toiletries, we should bring along adequate toilet paper, alcohol-based hand sanitiser, sun block, insect repellent (containing DEET), extra pairs of glasses, eyeglass repair kit and menstrual supplies (for female relief workers). Other items such as toothbrush, toothpaste, skin moisturiser, soap, shampoo, lip balm, razor with extra-blades, scissors, nail clippers, cotton swabs, sewing kit, laundry detergent and small clothes line/pins should also be included.

We should also pack comfortable, light-weight clothing. To avoid mosquito bite, long pants and long sleeved shirts should also be brought. Other items include hat, boots, shower shoes, rain gear, handkerchief, towels and gloves.

Outdoor gears such as maps, compass, mosquito bed net, sunglasses, safety goggles, electricity converter, water proof watch, flashlight, spare batteries and knife (e.g. Swiss Army Knife) should also be brought.

To ensure maximum security, we should pack in a money belt: cash, cell phone (with charger and adaptor), candles, matches, lighters (in zip lock bags), copies of all important documents, immunisation schedule, credit cards and air tickets. More importantly, we should bring a list of emergency contact number, such as telephone numbers of local emergency services, airlines, hotels, tour guides, close relatives and friends.

Do not forget to bring along comfort objects such as religious items and family photos.

## **Summary**

Tsunami is one of many natural disasters that can create a massive negative impact on humans. It can involve a large number of casualties with tsunami-specific or water-related injuries and illnesses and potentially post-tsunami infectious diseases and long-term mental disturbance. Therefore, the treatment of these patients or other victims will call for different sets of knowledge, skills and preparation from those commonly encountered in the hospital-based emergency department.

## **References**

1. Halabrin N, Valdes R. How tsunamis work. [updated 2005 Jan; cited 2005 Jan]. Available from: <http://www.howstuffworks.com/tsunami.htm>
2. Holian AC, Keith PP. Orthopaedic surgery after the Aitape tsunami. *Med J Aust* 1998;169(11-12):606-9.

3. Centers for Disease Control and Prevention. Health effects of tsunamis. [updated 2004 Dec 31; cited 2005 Jan]. Available from: <http://www.bt.cdc.gov/disasters/tsunamis/healtheff.asp>
4. Tsunami: its potential health effects and their surveillance. Communicable Disease Watch [electronic resource] Volume 2, Number 1, Weeks 1-2 (December 26, 2004 - January 8, 2005). Hong Kong: Centre for Health Protection, Department of Health. Available from [http://www.info.gov.hk/dh/diseases/CDwatch/grp-CDW\\_V2\\_01-en-20050112.pdf](http://www.info.gov.hk/dh/diseases/CDwatch/grp-CDW_V2_01-en-20050112.pdf)
5. Moszynski P. Disease threatens millions in wake of tsunami. *BMJ* 2005;330(7482):59.
6. Reminder note to medical carers for returned travelers from tsunami affected areas Dec 2004. Hong Kong: Centre for Health Protection; 31 December 2004.
7. World Health Organization. Background document: the diagnosis, treatment and prevention of typhoid fever [cited 2005 Jan]. Available from [http://www.who.int/vaccine\\_research/documents/en/typhoid\\_diagnosis.pdf](http://www.who.int/vaccine_research/documents/en/typhoid_diagnosis.pdf)
8. World Health Organization. Human leptospirosis: guidance for diagnosis, surveillance and control. 2003. [cited 2005 Jan]. Available from: [http://www.who.int/csr/don/en/WHO\\_CDS\\_CSR\\_EPH\\_2002.23.pdf](http://www.who.int/csr/don/en/WHO_CDS_CSR_EPH_2002.23.pdf)
9. Schmaljohn C, Hjelle B. "Hantaviruses: a global disease problem". *Emerging Infectious Diseases* 1997;3(2):95-104. [cited 2005 Jan]. Available from: <http://www.cdc.gov/ncidod/eid/vol3no2/downschm.htm>
10. Dengue hemorrhagic fever: diagnosis, treatment, prevention, and control. 2nd edition. Geneva: World Health Organization; 1997. Available from: <http://www.who.int/emc/diseases/ebola/Denguepublication/index.html>
11. Fact sheet on prevention and management of Japanese Encephalitis in hospital. Hong Kong: Central Committee on Infection Control, Hospital Authority; Nov 2004.
12. Rega PP, Batts D, Hall AH, McGovern TW. Glanders and Melioidosis. *eMedicine* [cited 2005 Jan]. Available from: <http://www.emedicine.com/emerg/topic884.htm>
13. Centers for Disease Control and Prevention. Emergency preparedness and response plan: plague information. [cited 2005 Jan]. Available from: <http://www.bt.cdc.gov/agent/plague/index.asp>
14. World Health Organisation. Fact sheet on meningococcal meningitis. [Updated 2003 May; cited 2005 Jan]. Available from: URL: <http://www.who.int/mediacentre/factsheets/fs141/en>
15. Weinberg AN, Swartz MN. Gram-negative coccal and bacillary infections. In: Freedberg IM, Eisen AZ, Wolff K, Austen KF, Goldsmith LA, Katz SI, editors. *Fitzpatrick's dermatology in general medicine*. 6th ed. New York: McGraw-Hill; 2003. p. 1897.
16. Weinberg AN, Swartz MN. Miscellaneous bacterial infections with cutaneous manifestation. In: Freedberg IM, Eisen AZ, Wolff K, Austen KF, Goldsmith LA, Katz SI, editors. *Fitzpatrick's dermatology in general medicine*. 6th ed. New York: McGraw-Hill; 2003. p.1927.
17. Radakovic-Fijan S, Graninger W, Muller C, Honigsmann H, Tanew A. Dengue hemorrhagic fever in a British travel guide. *J Am Acad Dermatol* 2002;46(3):430-3.
18. Bertolini J, Merlin M. Rabies. *eMedicine* [updated: 2004 Oct 12; cited 2005 Jan]. Available from: <http://www.emedicine.com/emerg/topic493.htm>.
19. Carden DL. Tetanus. In: Tintinalli JE, Kelen GD, Stapczynski JS, editors. *Emergency medicine: a comprehensive study guide*. 5th ed. New York: McGraw-Hill; 2000. p. 964-8.
20. Stroebe MS, Stroebe W, Hansson RO, editors. *Handbook of bereavement: theory, research, and intervention*. Cambridge [England]: Cambridge University Press; 1993.
21. *Diagnostic and statistical manual of mental disorders - DSM-IV*. Washington, DC: American Psychiatric Association; 1995.
22. Centers for Disease Control and Prevention. Interim vaccination and malaria prophylaxis recommendations for person traveling to areas affected by the tsunami. [cited 2005 Jan]. Available from: <http://www.bt.cdc.gov/coca/updates/2005jan3.asp>
23. Fact sheet on malaria prophylaxis for international travelers. Operational Panel 4, Hospital Authority Central Committee on Infectious Disease, Hong Kong. 2004 Sep.
24. Centers for Disease Control and Prevention. Tsunami disaster: health information for humanitarian workers. [cited 2005 Jan]. Available from: <http://www.bt.cdc.gov/disasters/tsunamis/humanitarian.asp>