Disaster management in Indonesia – what we have learned

Indonesia is located along the Pacific Ring of Fire — an area with a high degree of tectonic activity— and has to cope with the constant risk of volcanic eruptions, earthquakes, floods and tsunamis. Indonesia has more active volcanoes than any other country and houses some of the world's most famous volcanoes, Krakatau (Krakatoa), Tambora, and Merapi *[Figure 1]*. During and after a disaster, the risk of injury to people is high. The Indonesian Wound Care Clinician Association (InWCCA) in conjunction with the local governments aims to help injured people by sending dedicated wound care clinicians to the hospitals near the centre of the disaster. This article gives an overview of the strategy the InWCCA team applies when attending a disaster.

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Natural disasters, such as earthquakes, tornadoes, severe storms and floods affect thousands of people each year in Indonesia. They are often unexpected and can leave whole community injured and in shock. Depending on the nature of the disaster, e.g. an earthquake or flood, wounds may be contaminated with dirt, mud, seawater and debris. In addition, people who live through a disaster will experience emotional distress, such as anxiety and fear, trouble sleeping and other psychological symptoms. The InWCCA was started after the devastating earthquake in Piddie, Aceh Jaya, in 2016, and has continued to support people with injuries during all subsequent disasters, including the floods in Jakarta earlier this year. Typically, members of the InWCCA team will be stay between 3 weeks and 3 months to help with wound management at the disaster area.

Administrating first aid promptly can help heal small wounds faster and, in persons with open large wounds, can help prevent infections and other serious complications, such as tetanus, potentially saving limbs and lives. The recent disasters gave us the experience and insights that led to the development of a strategic protocol, based on data and cases studies we were able to collect. We believe that the provision of effective, safe and evidence-based wound care has to be a priority and that all clinicians need to understand that early and prompt treatment of patients with wounds can lead to a reduction in infections, morbidity and mortality. This article outlines the strategic plan our team has developed on how to respond to an emergency situation.

Natural disaster in Indonesia

The InWCCA in conjunction with the local government helped people at the following disasters: Earthquake Piddie Aceh Jaya (December 2016); Earthquake in Sinabung - Medan North Sumatera (March 2018); Wildfires in Preulak - Aceh (July 2018); Earthquake in Lombok - Nusa Tenggara (July 2018); Earthquake and Tsunami in Palu – Sigie – Donggala – Parigi Moutong, Central of Sulawesi (October 2018); Tsunami Banten - Lampung (December 2018); Floods in Samarinda – Kalimantan Timur (June 2019); Floods in Jakarta – Bogor (January 2020).

The types of wounds of the 765 cases we encountered during these disasters, included:

- Traumatic wounds (66%)
- Open fractured wounds (19%)
- Burns (8%)
- Diabetic foot ulcer (2%)
- Stoma (colostomy - ileostomy) (2%)
- Animal bites (1.5%)
- Wound cancer (1%)
- Pressure injury (0.5%).

Protocol

The following steps provide clinicians with a framework based on 7th steps of care planning *[Figure 2]*. Remember that disaster situations are not easy to handle and that sudden events can disrupt everything. Each step contains basic instructions and actions on what to do.

RISK EMERGENCY SITUATION

The first phase is focused on patient management in an emergency situation before tackling a basic wound care assessment and management. The

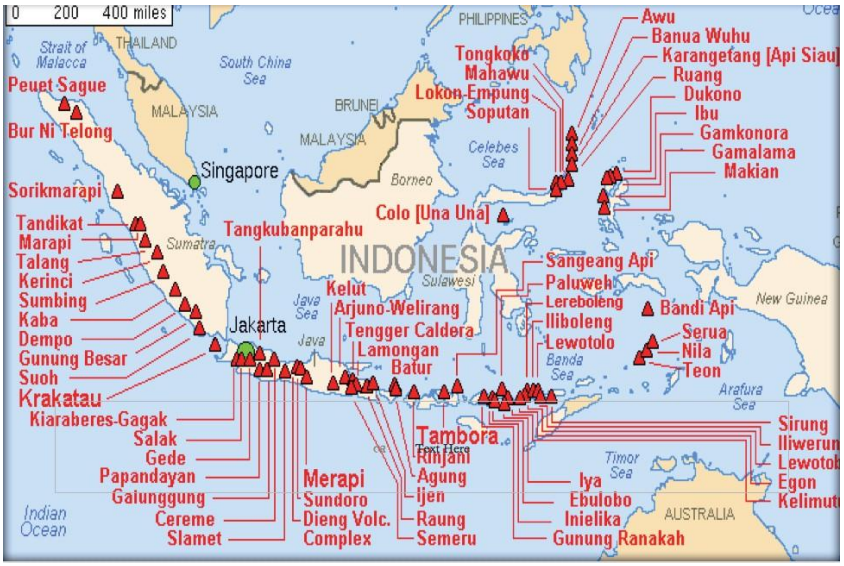

Figure 1. Map of volcanoes in Indonesia

Figure 2. Seven Steps Disaster wound management poster

risk emergency situation is called code "A" and may take a few days after the disaster occurred.

Step 1. Code A: ABC—Clear and management

Clinicians need to be aware of and understand the emergency situation by conducting a primary survey. Assessment of life and moving the patient away from any hazard are a priority. Early interventions include the securing the airways, breathing and circulation (ABC). Any bleeding needs to be stopped by applying direct pressure or using a tourniquet.

PREPARATION AND WOUND CARE MANAGEMENT PLAN

The second phase consists of four steps, each containing a number of clinical tasks. These are coded B, C, D and E and are designed to help assess the wound to recommend measures that will aid the wound healing process, thus minimizing the risk of sepsis and crush syndrome.

Step 2. Code B: Baseline wound assessment

The wound assessment is a process to help assist clinical decision-making about the appropriate treatment for the patient. The assessment begins by looking at the patient's whole condition to determine any comorbidities or other factors that will predict the healing response. The wound needs to be re-assessed at least every 48 hours to see the progression of wound healing and to predict the results of the treatment.

Wound care clinicians need to note and document the wound's characteristics, including location, shape, size, depth, edges, undermining and tunnelling, necrotic tissue characteristics, type of exudate, surrounding skin colour, peripheral tissue oedema and induration as well as the presence of granulation tissue and epithelialization *[Figure 3]*. They also need to identify and remove foreign bodies, record any impairments and disabilities and the presence or absence, quantity and quality of wound drainage.

Step 3. Code C: Cleansing

Proper irrigation with a non-cytotoxic solution such as normal saline or tap water significantly reduces the risk of wound infection. Based on the appearance of the wound, the surrounding skin and systemic signs of infection, clinicians might consider using a gentle antiseptic. Assertive cleaning and debridement are required to remove any foreign bodies or devitalized tissue to reduce contamination and the risk of wound infection *[Figure 4]*.

Step 4. Code D: Dressing and documentation

The dressing selected should provide or maintain a moist environment, enhance epidermal migration, promote new blood vessel formation and connective tissue synthesis, allow gas exchange between wounded tissue and environment, maintain appropriate tissue temperature to improve the blood flow to the wound bed and enhance epidermal migration. It should protect against bacterial infection, should be non-adherent to the wound and easy to remove after healing and must be sterile, non-toxic and non-allergic *[Figure 5]*. Where possible, treat wounds with advanced wound dressings, e.g. alginate, hydrogel, hydrocolloid, foam or Patients should also be given strict instructions to monitor themselves for signs of infection, which include increased warmth, erythema, pain, swelling or drainage from the wound.

Documenting the wound assessment should be a part of the protocol. Photographs are an accurate, visual record of the wound and help depict the patient's progress and condition. The photographs not only serve as a record of the wound at baseline and a validation of the overall treatment outcome, they are an effective tool for referrals, reimbursement, patient education and encouragement. Using e-technology also greatly helps to report urgent needs for supply. In turn, accelerating procurement can support continuous improvements in disaster situations.

Step 5. Code E: Evacuation and transfer

Having made sure that Code A has been followed and CODE B, C, D has been applied, the patients

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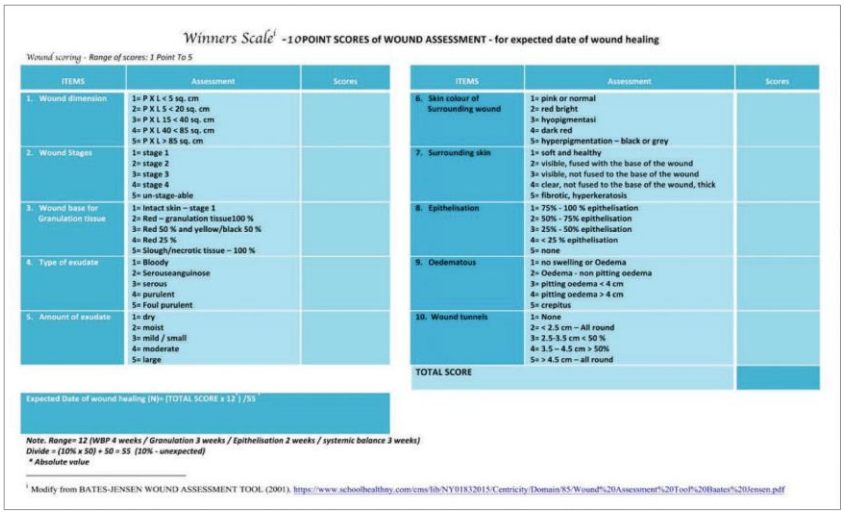

Winners Scale[1] -10POINT SCORES of WOUND ASSESSMENT - for expected date of wound healing

Wound scoring - Range of scores: 1 Point To 5

ITEMS	Assessment	Scores
1. Wound dimension	1= P X L < 5 sq. cm 2= P X L 5 < 20 sq. cm 3= P X L 15 < 40 sq. cm 4= P X L 40 < 85 sq. cm 5= P X L > 85 sq. cm	
2. Wound Stages	1= stage 1 2= stage 2 3= stage 3 4= stage 4 5= un-stage-able	
3. Wound base for Granulation tissue	1= Intact skin – stage 1 2= Red – granulation tissue100 % 3= Red 50 % and yellow/black 50 % 4= Red 25 % 5= Slough/necrotic tissue – 100 %	
4. Type of exudate	1= Bloody 2= Serouseanguinose 3= serous 4= purulent 5= Foul purulent	
5. Amount of exudate	1= dry 2= moist 3= mild / small 4= moderate 5= large	

ITEMS	Assessment	Scores
6. Skin colour of Surrounding wound	1= pink or normal 2= red bright 3= hyopigmentasi 4= dark red 5= hyperpigmentation – black or grey	
7. Surrounding skin	1= soft and healthy 2= visible, fused with the base of the wound 3= visible, not fused to the base of the wound 4= clear, not fused to the base of the wound, thick 5= fibrotic, hyperkeratosis	
8. Epithelisation	1= 75% - 100 % epithelisation 2= 50% - 75% epithelisation 3= 25% - 50% epithelisation 4= < 25 % epithelisation 5= none	
9. Oedematous	1= no swelling or Oedema 2= Oedema - non pitting oedema 3= pitting oedema < 4 cm 4= pitting oedema > 4 cm 5= crepitus	
10. Wound tunnels	1= None 2= < 2.5 cm – All round 3= 2.5-3.5 cm < 50 % 4= 3.5 – 4.5 cm > 50% 5= > 4.5 cm – all round	
TOTAL SCORE		

Expected Date of wound healing (N)= (TOTAL SCORE x 12) /55

Note. Range= 12 (WBP 4 weeks / Granulation 3 weeks / Epithelisation 2 weeks / systemic balance 3 weeks)
Divide = (10% x 50) + 50 = 55 (10% - unexpected)
* Absolute value

[1] Modify from BATES-JENSEN WOUND ASSESSMENT TOOL (2001). https://www.schoolhealthny.com/cms/lib/NY01832015/Centricity/Domain/85/Wound%20Assessment%20Tool%20Bastes%20Jensen.pdf

Figure 3. *Example of a wound assessment chart (adapted from Bates-Jensen, 2001)*

Figure 4. *Applying code C. Using normal saline and a gentle antiseptic to clean the wound*

Figure 5. *Applying Code D. Dressing the patient's wounds*

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will either be sent to a base camp, hospital camp or hospital. Pre-hospital care is important in patients with significant open large wounds or crush injuries. Early administration of intravenous or oral antibiotics prescribed by medical health officers might be needed to control the risk of infection. Normal saline should be administered because of the risk of worsening pre-existing hyperkalaemia and the inability to accurately monitor urine output. The eventual goal is to maintain urine output at 1 to 2 mL/kg/h. Bleeding must be controlled.

EVALUATION

Wound healing is usually characterized by four sequential but overlapping phases: haemostasis (0-several hours after injury), inflammation (1-3 days), proliferation (4-21 days) and remodelling (21 days-1 year) (Dhivya et al, 2015). Transition from the inflammatory to the proliferative phase is a key step during wound healing and evidence associates a compromised transition with the development of chronic wounds and wound infections. Clinicians need to base their rationale for therapeutic interventions on this knowledge.

Step 6. Codes F: Follow-up care

Follow up is crucial for patient health and for minimizing safety and liability concerns. When the wound is re-inspected, the presence of erythema, purulent exudate, necrotic tissue and oedema are all signs that the wound needs further cleaning and debridement, antibiotic therapy should be considered and that the patient might need to be referred. However, not all skin redness is the result of infection but may be due to an allergic reaction to the dressing or inflammation. Chronic wounds are often heavily contaminated and colonized, which can increase the risk of infection.

COLLABORATION

A multidisciplinary approach towards disaster management has been shown to achieve best patient outcomes (Hendricks et al, 2016).

Step 7. Code G: Collaborate and use multidisciplinary approach

Code G is a call for multidisciplinary collaboration if the wound is getting worst and infected. Surgical wound debridement and systemic antibiotics are often necessary to manage a significant wound infection. Reaching out and working with allied healthcare professionals from the multidisciplinary team is essential in looking after people affected by disasters.

Discussion

Almost a hundred of our wound clinicians who worked in disaster areas have used this protocol and agreed with its concept and principles. The challenges and problems in managing wounds during disasters include access to the affected areas and the victims. Other problems include the absence of appropriate electrical power supply, unhygienic environment, poor lighting, non-sterile instruments and lack of clean water. There is likely to be a shortage of food, milk and water. Affected people are likely to develop respiratory infection, have problems associated with childbirth and pregnancy; develop leptospirosis and/or mental health disorder. Appropriate donations of dressing materials and medicines are needed promptly.

Depending on the nature of the disaster, the wounds noted showed a variety of characteristics. The most common complications were wound infections typically caused by contamination with dirt, mud, water, faeces or a foreign body.

The advanced dressings and products we used in our basecamp came from donation, e.g. gauze, zinc cream, hydrocolloid dressing, calcium alginate and bandages.

Summary

Disaster situations are not easy to understand and manage but the objective to help the injured as early as possible must be paramount. The management of wounds during a disaster presents a significant challenge, especially if the number of victims is large, i.e. earthquake in Aceh, Lombok and Palu. The most critical steps are to clean, debride and dress the wound, then review the wound at least every 48 hours to prevent or manage infections that can pose a risk to the life and limbs of the injured person. Close partnership working between healthcare professionals and institutions are essential. WAS