

Treating natural disaster victims is dealing with shortages: An orthopaedics perspective

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Received 28 February 2008

Revised /Accepted 22 March 2008

Abstract. During natural disasters such as earthquakes or tsunamis, most of the casualties are known to suffer from musculoskeletal injuries. This leads to an enormous need of orthopaedic (surgical) implants such as osteosynthesis plates, which are difficult to provide in developing countries that rely on imported ones. One of the alternatives is utilization of local resources, but only after they have been proven safe to use, and meet the international standards set. Through this paper we would like to urge the international community to include locally produced biomedical products, like osteosynthesis plates in their scientific evaluations and communications. When the quality of local products is proven, the reluctance to use local products also by surgeons from developing countries will disappear and larger scale production can be initiated. This in its turn solves many problems that come after natural disasters and stimulates the national economy in an efficient and effective way.

Keywords: Natural disaster, orthopaedic, osteosynthesis plate, local resources

1. Introduction

A heavy earthquake, with a magnitude of 6.3 on the Richter scale, struck the Indonesian island Java on 27 May 2006 at 05:54 local time, around 25 km south-southeast of the city of Jogjakarta. The earthquake caused 5,782 deaths, while 36,299 people were injured, 135,000 houses damaged, and an estimated 1.5 million people were left homeless. The Tsunami of 26 December 2004 [3] caused world-wide 186,983 deaths, 125,000 injured and 42,883 missing persons.

Earthquake and Tsunami casualties are known to suffer mainly from musculoskeletal injuries, especially fractures due to collapsed walls and other building structures. After the Jogjakarta earthquake, almost 60% of all injured people were casualties with fractures requiring orthopaedic surgery (Fig. 1).

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Fig. 1. Earthquake and tsunami victims.

This constituted an impossible task for the seven orthopaedic surgeons practicing in the city of Jogjakarta. In addition, many paramedics happened to live in the Bantul district, which suffered most from the earthquake. The board of directors of the Indonesian Orthopaedic Association (PABOI) and the National Coordination Board for Disaster (BAKORNAS) responded fast to this disaster and directed orthopaedic surgeons and surgery teams from almost all over Indonesia to Jogjakarta to assist in treating the casualties. These and foreign relieve teams had to reach Jogjakarta by car or via the nearby airport of Solo, since the Jogjakarta airport and railway station were closed due to heavy damage. During the first days after the earthquake, surgical teams worked around the clock, mostly doing debridement of wounds and provisional stabilisation of fractures.

In Sardjito General Hospital, the referral hospital in Jogjakarta, 15 surgery teams worked simultaneously, and within 3×24 hours the acute phase for all casualties was considered over (Tables 1–4). That was only the beginning, however, of the overall work to be done, because now patients either needed definitive surgery for their fractures, or a second operation for infected wounds (Table 5). Infections were rampant since antibiotics, mandatory in the treatment of open fractures, were not available for such large numbers of casualties. Moreover, often the definitive fixation of fractures was impossible due to lack of osteosynthesis plates, screws, nails and external fixators, which all have to be imported from Western countries (Fig. 2).

The lack of bone plates has three causes. First, imported bone plates are very expensive. Although not officially stated, the Indonesian ministry of health initially said that their budget could only provide surgical implants for one thousand patients, which is only a fraction of the number of patients in need of a plate. Moreover, most people in Indonesia have no health care insurance. When they suffer from illnesses, like fractures due to the frequently occurring traffic accidents, and need surgery, they usually cannot afford the high costs of an operation and imported osteosynthesis plates. An orthopaedic operation using such an implant in Indonesia costs about USD 700 or more. Considering that the Gross Domestic Product (GDP) in Indonesia is USD 3,390, while only USD 110 is spent on health care per capita per annum [2], it becomes clear that adequate treatment for the earthquake victims according to Western

Table 1
Number of casualties treated in dr. Sardjito hospital by age and gender after the May 2006 earthquake on the Indonesian island Java

Age (y.o.)	Gender		Total	Death
	Female	Male		
0–10	24	21	45	
11–20	48	36	84	
21–30	253	111	364	21
31–40	265	176	441	13
41–50	167	86	253	11
51–60	122	96	218	18
61–70	55	36	91	31
71–80	29	24	53	24
> 81	15	13	28	11
Total	978	599	1.577	129 (8.2%)

Table 2
Number of casualties treated in dr Sardjito Hospital by age and region after the May 2006 earthquake on the Indonesian island Java

Age (y.o.)	Region			TOTAL
	Lower extremity	Upper extremity	Upper and lower	
0–10	24	21	–	45
11–20	44	34	6	84
21–30	196	76	12	284
31–40	244	117	8	369
41–50	182	36	5	223
51–60	86	56	4	146
61–70	53	22	–	75
71–80	18	14	11	43
> 81	5	4	3	12
TOTAL	852	380	49	1.281

Table 3
Number of multiple injured casualties treated in dr Sardjito Hospital after the May 2006 earthquake on the Indonesian island Java

Lesion site (Primary)	Head	Chest	Abdominal	Pelvic	Spine	TOTAL
Upper extremity	23	6	3	–	–	32
Lower extremity	31	29	–	13	17	90
Head	25	–	–	–	–	25
Chest	17	46	–	–	–	63
Abdominal	–	–	40	–	–	40
Pelvic	14	–	–	32	–	46
Spine	33	–	–	14	75	122
TOTAL	143	81	43	59	92	418

standards is impossible. Secondly, importing plates from Europe is done by Synthes Indonesia, the local representative of the European bone plate manufacturer (Synthes Representative Office Indonesia, through PT Merapi Utama Farma). Synthes Indonesia does not have that many implants in stock and even collecting plates and screws from nearby countries did not yield a sufficient number of plates to treat all victims. Thirdly, donated surgical instruments and implants from overseas were delayed after

Table 4

Number of casualties with open fractures treated in dr Sardjito hospital after the May 2006 earthquake on the Indonesian island Java

Gustilo Classification	Upper Extremity	Lower Extremity	Number of patients	Intervention treatment		
				ORIF	External Fixation	Plaster cast
Type I	17	31	48	12	—	36
Type II	13	34	47	24	8	15
Type III:						
A	31	114	145	—	145	—
B	37	116	153	—	153	—
C	1	11	12	—	—	—
Total	99	306	405	36	306	51



Fig. 2. Fracture fixation using osteosynthesis plate.

arrival due to custom procedures and destroyed transport connections [6].

In order to overcome the shortage of surgical implants, implants can be re-used after appropriate cleaning to remove any potential pyrogenic or bacterial endotoxic substances as well as adhering microorganism [5], but this is only done reluctantly by accepting higher risks of infection and fracture of the used plate. Moreover, the availability of used bone plates is decreasing. The second alternative is utilization of local resources. Locally produced osteosynthesis plates are much cheaper and can be obtained faster than from abroad. In Indonesia there are at least four local manufacturers producing these plates. Until recently, only a few Indonesian orthopaedic surgeons were willing to use locally produced plates because there is no scientific evidence available of their quality. Locally produced plates have to be proven safe to use and have to meet the international standards with regard to surface properties like roughness and wettability in relation to biomaterial-centered infection, and with regard to mechanical properties like strength and resistance to fatigue, in order to convince orthopaedic surgeons to use them. Lack of knowledge on testing procedures and lack of testing equipment in Indonesia and other developing countries prevents rigorous studies on the quality of bone plates produced locally in the developing countries. Simultaneously, unawareness, lack of scientific challenge and associated poor chances of acceptance of scientific manuscripts dealing with evaluations of biomedical products made in developing countries, have demotivated scientists in the Western world to undertake such necessary studies. Incidentally it is noted, that other major disasters, like the south Asian Tsunami in the Indian ocean, and Katrina Hurricane in New Orleans experienced similar problems [4,7]. Long-term recovery and rehabilitation in the presence of the above described shortages are poorly understood, which constitutes a continuous threat to the victims, even many years after the disaster. Because the international

Table 5
Estimated number of complications at one month after treatment of casualties caused by the May 2006 earthquake on the Indonesian island Java

Complications	Open Fractures		Closed Fractures	TOTAL
	Type II	Type III		
Infection	21/405 (5.2%)	96/405 (23.7%)	65/439 (14.8%)	182 (14.8%)
Loss of fixation	–	33/405 (8.2%)	23/439 (5.2%)	56 (6.6%)
Inadequate fixation	–	47/405 (11.6%)	51/439 (11.6%)	98 (11.6%)
Unacceptable position		36/405 (8.9%)	39/439 (8.9%)	75 (8.9%)

attention is fading rapidly within days after a disaster [1], international support for long-term recovery and rehabilitation programs is only limited.

Through this paper we would like to urge the international community to include locally produced biomedical products, like osteosynthesis plates in their scientific evaluations and communications. International research on these products should be stimulated and considered in peer-reviewed journals. When the quality of local products is proven, the reluctance to use local products also by surgeons from developing countries, will disappear and larger scale production can be initiated. This in its turn, solves many transport problems after natural disasters. As an extra advantage, local economies will be stimulated in an efficient and effective way.

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