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ORIGINAL PAPER

Quality orthopaedic care in sudden-onset disasters: suggestions from *Médecins Sans Frontières*-France

Patrick Herard[1] · **François Boillot**[1]

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Abstract A huge change is needed in the conception and implementation of surgical care during sudden-onset disasters (SOD). The inadequate surgical response mounted by the majority of foreign medical teams (FMT) after Haiti's earthquake is a striking example of the need for a structured professional approach. Logistical capacity already exists to provide safe, timely, effective, efficient, equitable and ethical patient-centred care with minimum standards. However, knowledge, skills and training in the fields of general, orthopaedic and plastic surgery need further clarification. Surgical activity data and clinical examples from several *Médecins Sans Frontières*–France (MSF) projects are used here to describe the skill set and experience essential for surgeons working in SOD contexts.

Keywords Sudden-onset disasters · Quality care · Surgical training

Introduction

From the *Médecins Sans Frontières*–France (MSF-F) experience, a change in the concept and implementation of surgical orthopaedic care is needed during sudden-onset disasters (SOD). Foreign medical teams (FMT) need to be more knowledgeable about the type of care they can provide, and recipient countries must be assured that FMTs that respond will meet or exceed specific international minimal standards.

In the 2010 earthquake in Haiti, there were two disasters—the first being the actual devastating earthquake and the second being the response to it. According to the World Health Organisation/Pan American Health Organisation (WHO/PAHO) Technical Consultation on FMTs in SODs, only 35 out of 340 teams were qualified as competent and prepared to manage care in the context of the earthquake [1, 2]. It has been previously discussed that >600 health agencies responded despite few of them having either the relevant expertise or capacity to deliver efficacious and appropriate treatment [3]. Responding FMTs ranged in size, competency, preparedness, training, ambition and reputation; many responders appeared on site without tetanus prophylaxis, waste management knowledge or logistical skills.

The number of avoidable amputations in a sudden-onset disaster has been well discussed [4]. Without careful planning and logistical support on the ground, well-intentioned but ill-prepared medical teams may find themselves in untenable situations. It is clear from anecdotal evidence from those who decided to respond on their own by creating their own response teams were not prepared to handle the logistical aspects of maintaining an effective orthopaedic FMT on the ground [1].

MSF data from different SODs demonstrate technical standards and specific surgical profiles that should be deployed to such catastrophes. Each situation will be different, and many different factors will affect FMT efficacy. These different factors will range from the specific context, economic profile of the country affected, type and intensity of the disaster, population size affected and the time it takes a FMT to arrive and become established. The specific type of SOD matters considerably in an FMT's decision to respond. From the medical literature, we know that casualties following tsunamis and

✉ Patrick Herard
pherard@paris.msf.org

[1] Medecins sans Frontières, 8 Rue St Sabin, 75544 Paris Cedex 11, France

earthquakes are often very different—the latter causing a devastating variety and range of inujuries and the former causing greater mortality [5].

The 2010 proceedings from the WHO/PAHO Technical Consultation on FMTs in SODs concluded that a mechanism of accreditation should be established to ensure that countries receiving aid are provided with an appropriate and effective level of care from all FMTs [2]. The predisaster context and type of disaster should guide the types of surgical profiles sent to intervene.

Materials and methods

For this report, retrospective data was used from routine programmatic data collected from MSF.

Results

Orthopaedic activity following an earthquake is characterised by a high number of open fractures to lower limbs (46 %), especially to the tibia and fibula (77 %), (Table 1), and by a high number of open fractures to lower and closed fractures to upper limbs [6–8]. From the MSF orthopaedic surgical project in Haiti following the earthquake, 264 fractures were treated (194 long bone) in the first three months. Fracture treatment was diverse, with 35 % treated conservatively, 34 % treated with external fixation and 31 % treated with internal fixation. It should be noted, however, that the majority of internal fixations took place after day 30 of the earthquake.

Within the category of orthopaedic procedures, reductions were the most common but reduced over time. The same trend was true for external fixation (including revisions) and amputation. In contrast, the number and proportion of internal fixation operations rose over time (though they did not start until after day 30 of the earthquake).

We know that tsunamis and earthquakes are very different in terms of pathologies and types of morbidities to patients that present for treatment (Table 2). From the MSF-France experience in the 2013 tsunami in the Philippines, there were far fewer orthopaedic surgical cases; the highest percentage of treatments were to wound patients (n=100; 47 %).

Data gathered from the three MSF sections present in Haiti (Table 3) provide a good view of the burden and types of surgeries following the earthquake, with n=5947 surgeries performed in the first three months. Wound and fracture care are the core MSF activities following an earthquake, but surgical obstetrics also play a role (5 %). These data can be examined in the context of a predictive graph from the Karolinska Institute [5].

Discussion

In responding to a SOD with a surgical team, it appears clear that two central facets must be considered: the logistical/operational aspects of deploying an FMT into an emergency context, and the surgical profiles of clinical personnel sent into the field. It is clear from the presented programmatic data that different surgical needs are necessary depending on the specific type of disaster. Temporal components of when and which type of surgical skills are also very important tenets to incorporate into a response appropriate to the ability of the FMT. One study looked at four earthquakes and FMT response and found that not one of the 43 foreign field hospitals arrived early enough to provide emergency trauma care [5].

Table 1 *Médecins Sans Frontières*–France (MSF-France) orthopaedic data, Haiti 2010

	Closed		Open	
Humerus	6	67 %	3	33 %
Forearm	11	79 %	3	21 %
Femur	70	89 %	9	11 %
Tibia–-fibula	21	23 %	69	77 %

Table 2 Types of surgeries performed by *Médecins Sans Frontières*–France (MSF-France) under general anaesthesia in two different sudden-onset disasters (SODs) (6 days to 6 weeks after the event)

Type of surgery	Earthquake: Haiti		Tsunami: Tacloban	
Minor	1093	37 %	60	28 %
Wound (graft, flaps)	994	34 %	100	47 %
Orthopaedic	664	22 %	12	6 %
Gynaecology/obstetrics	154	5 %	26	12 %
Visceral	62	2 %	13	6 %

Table 3 Surgical activity of three *Médecins Sans Frontières*–France (MSF) sections (OCP, OCB, OCA) in the first three months following the 2010 earthquake in Haiti

Type of surgery	1st Month	2nd Month	3rd Month	Total	Percentage
Minor	1027	759	399	2185	37
Wound (graft, flaps)	964	679	345	1988	33
Orthopaedic	749	303	275	1327	22
Gynecology/obstetrics	153	84	71	308	5
Visceral	45	46	48	139	2
Totals	2938	1871	1138	5947	

Logistical and operational needs

Logistical aspects regarding classification and minimum standards for FMTs in SODs are well defined by the WHO [9]. The guiding principles are to provide safe, timely, effective, efficient, equitable and patient-centred care in an ethically sound manner. Teams must be accountable to patients and the host country in addition to being integrated in the most effective way possible into the overall response. The authors of the WHO guide also stress the importance of having sound logistical support in place, such as ensuring that the basics of waste disposal, water and power are met in order to deliver effective care.

Surgical knowledge and training

Surgical care in a catastrophic SOD environment is different from that delivered in civilian trauma. We know that much can be done in a low-tech environment, such as soft tissue wound care and management of wounds with fractures. However, it is difficult for surgeons to switch from their regular practice when encountering open fractures or crush injuries. In a SOD, open fractures should be treated in the same manner as fractures from a conflict zone, with delayed primary closure. There should be aggressive debridement, and delayed primary closure should be performed after four to five days, in accordance with war surgery protocols.

In a SOD, crush injuries are often confused with compartment syndrome, which require different processes with similar pathophysiology and are frequently discussed interchangeably. A crush injury results from prolonged continuous pressure on large muscles, which in turn can cause muscle necrosis and the release of intracellular muscle constituents into the circulation leading to acute kidney injury. Compartment syndrome is a condition in which a structure has been constricted within a space compromising the circulation and tissue function within that space. Fasciotomies are surgical emergencies for compartment syndromes, and while they increase bleeding and coagulopathy, they also increase sepsis rates and will not improve complications related to kidney failure. One group that worked in the 2003 earthquake in Turkey reported that a routine fasciotomy was performed in nearly 70 % of all patients diagnosed with compartment syndrome and that 81 % of those patients developed sepsis from wound infections [10]. Studies from other earthquakes in China and Turkey demonstrated similar conclusions [11–13].

The WHO's Foreign Medical Team Working Group under the Global Health Cluster published an extensive guide on classification and minimum standards FMTs need in order to respond in a SOD [9]. In the guide, FMTs are divided into three distinct categories based on their capacity and capability [9]. For example, a type 1 team must be able to effectively perform initial wound care, whereas a type 2 team must be able to deliver full surgical wound care, and a type 3 team must have appropriate skills for providing complex reconstructive wound care [9].

The first surgeons to be sent to the field after an earthquake should be general surgeons trained in war surgery or SOD management. These surgeons must be able to perform caesarian sections. Orthopedic surgeons with training in plastic surgery—or plastic surgeons with trauma competencies—would be most useful on day four or five post-SOD. We believe there is little added value for an orthopaedic surgical profile in the early stage following a tsunami, as reconstructive surgical interventions can commence when the appropriate treatment facilities have been fully established.

There are very few formal training courses to better prepare surgeons for work in SODs. Various countries have set up three to five day training sessions, but we believe that nothing replaces previous experience working as a surgeon in an austere and complex environment. There is clearly space for more specific surgical training programmes, specifically like the one offered by the French military health service, Cachirmex (http://www.defense.gouv.fr/sante/actualites/cesimco-structure-dediee-a-la-simulation-chirurgicale-operationnelle).

Foreign medical teams with often specialised surgical expertise are needed in SOD responses. However, it seems clear from the experience of MSF and others that personnel with specific surgical profiles need to be sent at specific times and provided with appropriate levels of logistical support in order to provide the most efficacious treatment.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interests.

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