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**International Orthopaedics**

ISSN 0341-2695

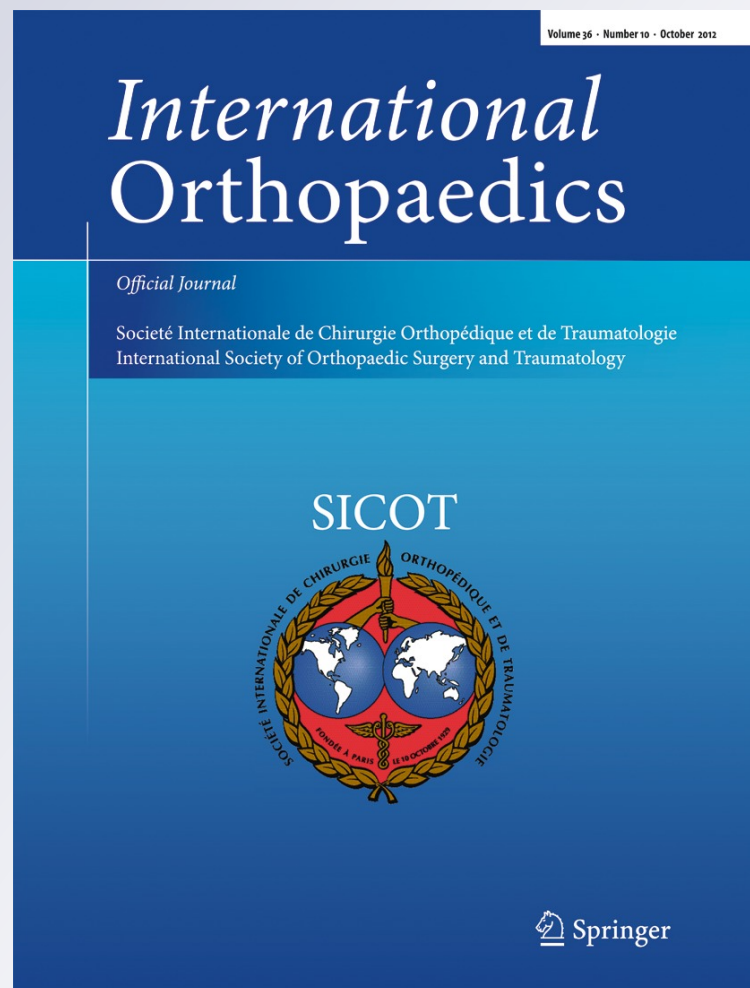
Volume 36

Number 10

International Orthopaedics (SICOT)

(2012) 36:1979-1981

DOI 10.1007/s00264-012-1552-3



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# Amputation in emergency situations: indications, techniques and Médecins Sans Frontières France's experience in Haiti

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Received: 25 January 2012 / Accepted: 10 April 2012 / Published online: 15 May 2012  
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## Abstract

**Purpose** The decision to amputate is always difficult but becomes even harder in emergency situations, which usually present extra complicating factors.

**MSF Experience** These include human factors (related to both the surgeon and the patient); poor or nonexistent medical facilities, especially in war conditions or resource-poor countries; and cultural and religious considerations. Médecins Sans Frontières (MSF) has developed a quick medical and logistical response that relies on surgical protocols adapted to emergency situations, together with complete “kits” of medical equipment, supplies and inflatable facilities.

**Conclusion** Our response to Haiti's 2010 earthquake relied on these tools but also highlighted the need to develop more detailed protocols that will help our teams on the ground.

## Introduction

Médecins Sans Frontières (MSF) is a 40-year-old international, medical humanitarian organisation that delivers emergency assistance to people affected by armed conflicts, epidemics and natural disasters. Missions are launched and managed through any of five operations centres (located in Paris, Geneva, Brussels, Amsterdam and Barcelona). This paper focuses on activities of the Operations Centre Paris (OCP).

Amputations are a difficult subject and always generate a great deal of discussion within the medical team. Working mostly under precarious conditions, at the beginning of an intervention surgical volunteers are briefed on MSF's

protocols and on the particulars of the country, which are well known by our permanent local teams.

Based on MSF's experience in natural disasters, about 75 % of the injuries typically seen in these situations are to limbs; in developing countries and unstable situations, approximately 50 % of open fractures lead to either infection or non-union. This is in agreement with earlier reports that found 43 % infection and 42 % non-union in Nigeria [1] and a 38–55 % complication rate in war surgery [2].

Deciding on the precise indications for amputation is always difficult, and the context can add complications. The factors that most often complicate these decisions are: human, quality and availability of medical facilities, and cultural and religious considerations.

**Patient** The patient's age is a consideration, given aging-related reduced healing and other factors, and has therefore been incorporated into standardised measurements such as the Mangled Extremity Severity Score [3] (MESS—see Table 1). The frequent presence of additional medical pathologies and/or multiple traumas must also be considered.

**Medical team** The experience of being in a natural disaster or war zone is often a great shock to civilian surgeons, and many have difficulty adapting to the drastically different conditions. As many as 15–20 % of limbs may need to be amputated, and unprepared surgeons are a menace in disasters. Surgeons need to be adaptable in resource-deprived situations, grounded in protocols [International Committee of the Red Cross (ICRC)-MSF-...] and able to step away from conventional practice. OCP sends only surgeons experienced in war or disaster zones into emergency situations.

**Facilities** Without careful planning and logistical support on the ground, well-meaning but ill-prepared medical teams may find themselves in untenable situations. Dr. David Helfet, Director of the Orthopaedic Trauma Service at the

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**Table 1** Mangled Extremity Severity Score (MESS)

Characteristic	Description	Points
Skeletal, soft tissue injury	Low energy (simple fracture, civilian GSW)	1
	Medium energy (open or multiple fracture, dislocation)	2
	High energy (close-range shotgun, crush injury)	3
	Very high energy (above + gross contamination, soft tissue avulsion)	4
Limb ischaemia	Pulse reduced or absent (but perfusion normal)	1 <sup>a</sup>
	Pulseless (paraesthesia, diminished capillary refill)	2 <sup>a</sup>
	Cool, paralysed, insensate, numb	3 <sup>a</sup>
Shock	Systolic BP always >90 mmHg	0
	Hypotensive transiently	1
	Persistent hypotension	2
Age	<30	0
	30–50	1
	>50	2

BP blood pressure

<sup>a</sup>Score doubled for ischaemia >6 h. A MESS score of greater than or equal to 7 had a 100 % predictive value for amputation

Hospital for Special Surgery (HSS) and New York-Presbyterian Hospital, described his experience after the Haiti earthquake [4] as follows: After organising a small team and supplies from HSS and New York Hospital, plus a company jet from Synthes, the group arrived at Haiti's main public hospital to find about 1,000 patients. "No electricity or water, while the operating room consisted of a plywood table in a storeroom". The team moved to a small community hospital "which was in better shape, but...there was no security, we began running out of supplies. Patients were angry because we could not help them, and it was clear that the situation was deteriorating. The team left on a Canadian charter plane, depressed, and knowing that we had left the job unfinished". His conclusion: "You just can't go in alone. It's inefficient, distracts from the work".

As Helfet's experience illustrates, effectiveness in disaster zones means satisfying enormous logistical requirements (water, electricity, waste management, etc.) and medical needs. For the latter, MSF has developed a variety of "kits"—pre-assembled collections of equipment, renewable supplies, drugs needed for surgery—up to and including kits with everything needed to set up a full hospital (inflatable tents with operating theatres, recovery rooms, sterilisation unit, radiology unit, laboratory). In the first 12 days post-earthquake MSF sent 17 planes to Haiti with kits for all five MSF operating centres, supplementing our facilities already established in the country. MSF-OCP was therefore able to set up an additional 220-bed facility on a sports field in Port-au-Prince.

*Cultural and religious* Religion can be a strict barrier to amputation. According to Sharia law the human body belongs to Allah and man has a formal commitment to preserve his body integrity. ( وَاَتَقَتُّ وَالْأَنْفُكَ إِنَّهُ كَانَ بِكَ حَيٍّ [ان: 29]. The interpretation of this law is very restrictive in some areas and can be a formal contraindication, or eventually a real danger for the surgeon. Cultural aspects

of other religions can sometimes have a similar weight and impact.

It is crucial that medical teams of expats have sufficient on-the-ground experience and/or local staff or partners so they can incorporate all these factors into their decision-making and interactions with patients.

### Haiti context

In Haiti, amputations became a huge topic in the public mind and in the media. A preliminary report from Handicap International projected the number of amputees to be over 2,000 and possibly up to 4,000 [5], although later this number came to be seen as an overestimate. These figures should be viewed against a context of 230,000 people dead and 300,000 wounded.

During the first 12 days MSF-OCP performed 29 amputations on 26 patients, from a total of 135 patients operated upon for 211 interventions. Amputation during the immediate post-earthquake phase therefore represented 19 % of patients (26/135) and 13 % of interventions (29/211). In 47 % of the cases it was a first indication and in 38 % a second operation, with this information not available for the remaining 15 % not recorded. Overall, in the three months after the earthquake, all MSF teams collectively performed 4,863 operations, of which 182 (3.7 %) were limb amputations (unpublished communication, J. von Schreeb, Karolinska Institutet, Stockholm).

### Indication for amputation at MSF

While the decision to amputate is straightforward when it will save a patient's life—for example, in patients with early

gangrene or uncontrolled bleeding—it is more difficult in cases of severe nerve damage. For OCP in Haiti, the core consideration for this decision was to ask the question: In this specific setting, with the facilities and care available here, will the patient be able to walk on it within 12 months? Based on the recognition that more detailed guidelines would be useful, MSF recently introduced the MESS into our protocols. From now on this score will be recorded in all of our operative reports and evaluated prospectively for its value in facilitating decisions in future disaster scenarios.

### Surgical technique

Our protocol also specifies how amputations should be carried out. Guillotine amputation is forbidden. Only fish mouth flaps are to be performed, and flaps should be long enough to cover the soft tissues of the stump. The amputation must remove all dead, contaminated, contused tissues with delayed primary closure. The flaps need to be cut long, allowing them to retract; patient's muscle and fascia are left unsutured. Secondary closure is performed three to five days later.

On the inferior limb we perform the two standard amputations: below knee and above knee with a minimum of 5 cm on the tibia shaft (ideally 12–14 cm) and 10 cm on the femur (ideally 25–28 cm). The scar should be as far posterior as possible. On the superior limb every centimetre counts, especially in situations where the patient is unlikely to get an arm prosthesis, and we always preserve as much length as possible.

Postoperative care in disaster zones is most often the job of the surgeon, who typically also functions as a physiotherapist. The stump needs an appropriate firm bandaging to

hasten conversion from a bulky cylinder to an appropriate cone, and pain (including phantom pain) must be managed. Surgeons often also train patients in how to exercise.

### Conclusion

Amputation remains a difficult decision, always taken with written consent from the patient (and family, whenever possible) after formal indication is agreed by two physicians. The decision can vary according to the level of care available, patient conditions and local or cultural commitments. MSF protocols do not allow for multiple procedures on limbs with vascular or nerve injury in precarious, resource-poor settings, and they emphasise that our surgeons should never endanger life when an infection is present. Assessing the MESS routinely in the future will allow us to evaluate its accuracy and usefulness as a guide for decisions on amputations in disaster situations.

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