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# 1 Canadian Field Hospital in Haiti: surgical experience in earthquake relief

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Accepted for publication  
Mar. 24, 2011

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DOI: 10.1503/cjs.039010

The Canadian Forces' (CF) deployable hospital, 1 Canadian Field Hospital, was deployed to Haiti after an earthquake that caused massive devastation. Two surgical teams performed 167 operations over a 39-day period starting 17 days after the index event. Most operations were unrelated to the earthquake. Replacing or supplementing the destroyed local surgical capacity for a brief period after a disaster can be a valuable contribution to relief efforts. For future humanitarian operations/disaster response missions, the CF will study the feasibility of accelerating the deployment of surgical capabilities.

L'hôpital déployable des Forces canadiennes, le 1er Hôpital de campagne du Canada, a été envoyé à Haïti après un tremblement de terre qui a causé une dévastation massive. Deux équipes chirurgicales ont effectué 167 opérations au cours d'une période de 39 jours ayant débuté 17 jours après l'événement indice. La plupart des interventions chirurgicales n'étaient pas reliées au tremblement de terre. Le remplacement ou la supplémentation pendant une courte période de la capacité chirurgicale locale détruite à la suite d'une catastrophe peut être une contribution précieuse aux efforts de secours. En vue de futures missions de chirurgie humanitaire et réponse aux catastrophes, les Forces canadiennes étudieront la possibilité d'accélérer le déploiement des capacités chirurgicales.

**O**n Jan. 12, 2010, a 7.0-magnitude earthquake occurred in Haiti. The intensity of the earthquake and the frailty of the buildings in most of the country combined to cause extensive structural damage and casualties.<sup>1,2</sup> An intense multinational relief effort followed.

The Canadian Forces (CF) contributed by sending a contingent of more than 2000 personnel.<sup>3</sup> This included 1 Canadian Field Hospital (1 CFH), the CF deployable field hospital. While 1 CFH itself provided the core nucleus of staff for the hospital, 21 reserve and regular forces units across Canada also provided personnel. The full contingent of 117 CF members was first assembled in Petawawa, Ont., home of 1 CFH. Ninety-seven were medical or dental personnel, including medics; dental, laboratory, x-ray and operating room (OR) technicians; pharmacists; nurses; physicians; and surgeons. The remaining 20 were from various nonmedical trades, including signallers, truckers, mechanics, logisticians and others. From Petawawa, the unit moved by ground to Canadian Forces Base Trenton and then by air to Port-Au-Prince on the recently acquired CC-177 aircraft.

The first elements of 1 CFH arrived in theatre on January 21. It was decided to position 1 CFH in Léogane, a hard-hit town near the epicentre of the earthquake. Over the next few days, the hospital personnel arrived and contributed to establishing the hospital. Security was provided by 3 Battalion Royal 22e Régiment and naval personnel from the HMCS Athabaskan. Once it was fully operational, the hospital had a 100-bed ward, a 4-bed intensive care unit, radiology and dental suites, a primary care section, a laboratory and 2 ORs (Fig. 1). The first OR became functional on January 29. There were 2 surgical teams, each consisting of an anesthesiologist, general surgeon, orthopedic surgeon, OR technician and OR nurses. This paper discusses our surgical experience during this deployment.

## SURGICAL EXPERIENCE

The surgeons kept a log of operations performed in the OR. The patient data collected included age, sex, diagnosis, surgical procedure and mechanism of injury. The OR nurses kept a separate case log. At the end of the deployment, the 2 were compared to ensure the accuracy of all entries.

During the mission, 4922 patient encounters occurred at 1 CFH. The vast majority involved primary care providers. The radiology department performed 1143 imaging studies, including 235 ultrasounds.

The OR was in operation from January 29 to March 8. During this period, 167 operations were performed in 151 patients. Two patients were CF members, whereas all others were Haitian nationals. Twenty-three patients (15%) were younger than 18 years of age. Twenty patients (13%) had earthquake-related injuries. The remainder had a mix of traumatic and atraumatic problems not related to the earthquake. Surgical referrals came either from primary care providers within the hospital, from other CF units within the country (including the Disaster Assistance Response Team [DART]) or from nongovernmental organizations (NGOs) in the region.

The most frequent surgical procedures were inguinal hernia and hydrocele repairs ( $n = 69$ ). Other common procedures included hysterectomy ( $n = 12$ ), open reduction and internal fixation of long bone fractures ( $n = 12$ ), external fixation ( $n = 7$ ), umbilical hernia repair ( $n = 6$ ), amputations ( $n = 6$ ) and circumcision ( $n = 6$ ). There were 5 complications (3%) that required reoperation: 1 scrotal abscess following hydrocele repair, 1 postoperative bleed following hysterectomy, 1 loss of fixation of a distal radius fracture following a corrective osteotomy, 1 neck hematoma following the excision of a giant cyst and 1 recurrent infection following below-knee amputation. There were no postoperative deaths.

## EARTHQUAKE RESPONSE

Our unit was able to deploy on short notice and provide high-level care to the Haitian population. Surgical patients accounted for only 3% of patient encounters. This is analogous to the experience of other field hospitals that have deployed to earthquake disaster zones. The 212th Mobile Army Surgical Hospital reported that 90% of its workload consisted of primary care after the earthquake in Kashmir in 2005.<sup>4</sup> The requirements for surgical care decreased quickly after the first month.<sup>4</sup> Similarly, an American civilian field hospital that deployed to the Bam, Iran, earthquake region in 2003 performed only 6 surgical procedures while seeing a total of 727 patients.<sup>5</sup>

Owing to the 17-day delay between the earthquake and the establishment of surgical capacity, most of our case load was not directly related to the earthquake. Most casualties had, at that point, been brought to other facilities or had

died of their injuries. This is also consistent with the experience of other surgical units during earthquake response.<sup>6,7</sup> In the vast majority of cases, the window of opportunity to perform life-saving surgery has passed when the deployed surgical teams become operational.<sup>6-8</sup> World Health Organization guidelines state that to provide life-saving trauma resuscitation and surgery, a unit should be on site and operational within 24 hours.<sup>9</sup> In 1999, the Israeli Defence Forces (IDF) Field Hospital deployed to Turkey 4 days after an earthquake with a magnitude of 7.4 on the Richter scale.<sup>10</sup> Initially, there was a high proportion of acute trauma patients, but this decreased progressively over the next 10 days. In the case of the Haiti earthquake, the IDF Field Hospital deployed to Haiti within 3 days and treated a much greater proportion of earthquake victims than 1 CFH did.<sup>11</sup> The USNS Comfort, an American hospital ship, started receiving patients 7 days after the earthquake; many patients had severe trauma.<sup>12</sup> Our main surgical contribution was to treat neglected chronic conditions in an area where the medical infrastructure had been destroyed by the earthquake.

Liaison with NGOs, local health care facilities and other military medical units was essential to patient care. It allowed interfacility referrals when appropriate. More importantly, it helped us ensure our patients would receive adequate postoperative care and rehabilitation after our departure. We felt it was our obligation to ensure local follow-up for all our patients. Medical liaison in this context is an active process that involves visiting other medical facilities to assess their capacity to care for specific patients. This was a multidisciplinary effort involving a variety of health care providers and administrators. The information obtained influenced, in some cases, the decision to go ahead with surgical procedures. It is in the best interest of the local population that a surgical hospital be as fully integrated as possible within the broader disaster relief effort.

Despite being in an austere environment, established OR standards were adhered to as closely as possible. In our experience, there were only 5 complications requiring reoperation. Complete documentation of other complications was not possible in this environment, as our follow-up period was short and the rate of loss to follow-up high.

Data collection in war and disaster situations can be problematic. The data we were able to collect will help the CF prepare for future humanitarian and disaster response operations. The process of data collection should be integral to such missions. Ideally, a computerized database would be used, and dedicated personnel would be responsible for data collection.

This mission was a success in many ways, notably by providing full-spectrum medical care in an area without functioning health facilities. It also highlighted that greater clinical benefit might be achieved through a lighter and more rapidly mobile surgical/resuscitation team for future CF humanitarian and disaster response operations. This



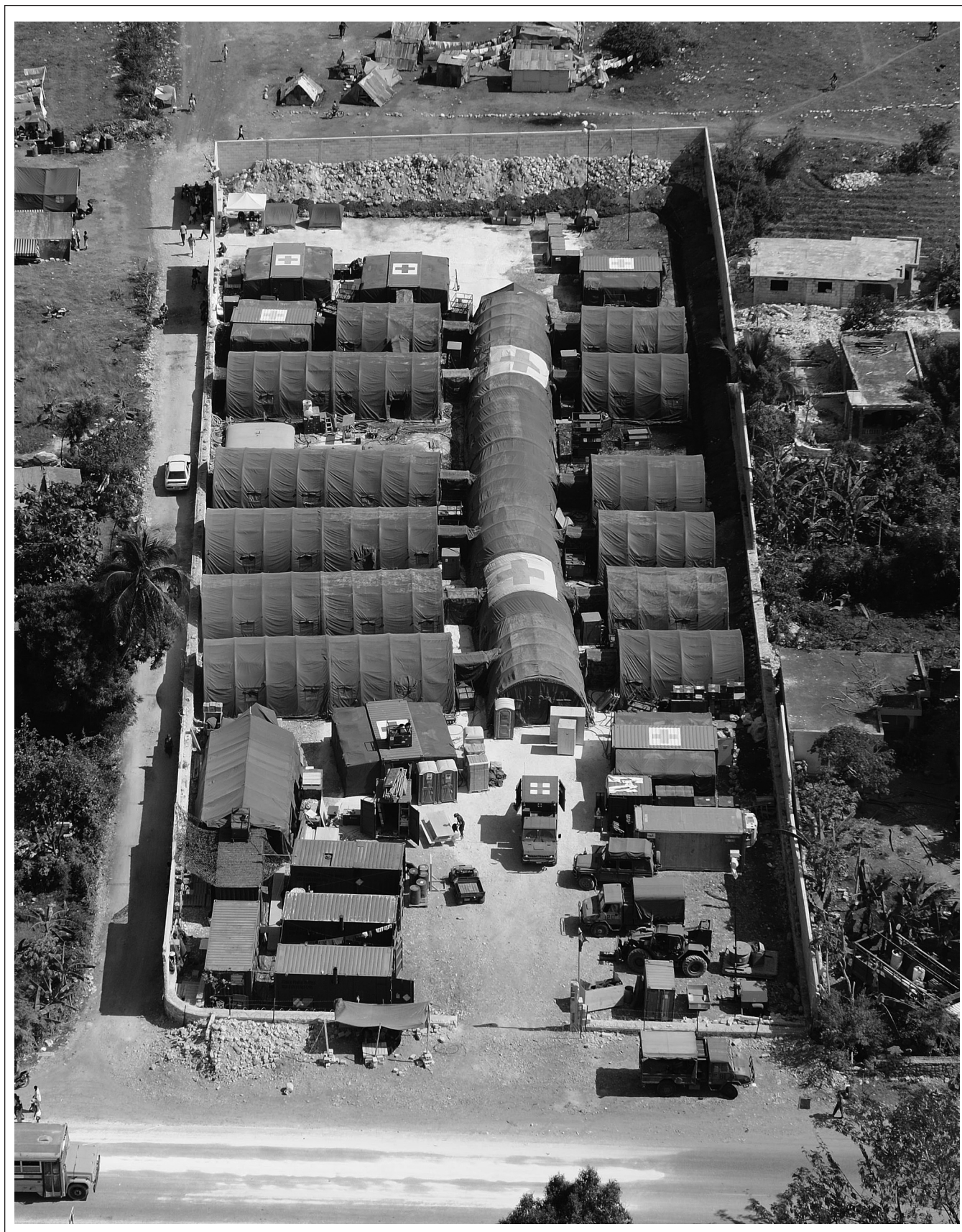


Fig. 1. 1 Canadian Field Hospital in Léogane, Haiti, February 2010.

team would focus on emergency and trauma surgery. Ideally, this surgical capacity would be deployed early enough to provide acute trauma care to persons affected by the disaster. If this is not possible owing to logistical or geographical constraints, the capacity to perform emergency surgery can still be useful if local health care facilities have been damaged by the disaster.

Rapid deployment of surgical assets in mass casualty scenarios would provide the greatest clinical benefit. As it does after every operation, the CF is reviewing lessons from Haiti with the aim of enhancing the effectiveness of its response wherever possible.

**Competing interests:** None declared.

**Contributors:** M. Talbot, C. Berger and V. McAlister designed the article. M. Talbot, B. Meunier, V. Trottier, T. Hillier, V. McAlister and S. Taylor acquired the data. M. Talbot, T. Hillier, M. Christian and V. McAlister analyzed the data. M. Talbot, M. Christian and V. McAlister wrote the article. All authors reviewed the article and approved its publication.

**Disclaimer:** This paper represents the views of the authors and does not represent the official views of the Canadian Forces, the Department of National Defence or the Canadian government.

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