Tornado at Pine Lake, Alberta — July 14, 2000

Assessment of the emergency medicine response to a disaster

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Introduction

Les programmes de médecine et de résidence négligent souvent l'enseignement de la médecine de catastrophe, mais lorsqu'une catastrophe se produit, c'est le personnel de médecine d'urgence qui se retrouve au front. Les médecins d'urgence doivent se familiariser avec le plan de sinistre de leur hôpital et être prêts à participer à l'opération de sauvetage.

La tornade de Pine Lake en Alberta, le 14 juillet 2000, a démontré l'importance d'une planification en cas de sinistre et le rôle prédominant joué par la communauté de médecine d'urgence. Les médecins, les techniciens ambulanciers et les infirmières se déployèrent rapidement sur les lieux du sinistre. Avec l'aide des services médicaux d'urgence régionaux (SMU), de l'hôpital régional de Red Deer et des hôpitaux de soins tertiaires de l'Alberta, ils procédèrent au triage des victimes, à leur stabilisation et à leur transport.

La catastrophe de Pine Lake devrait motiver la communauté canadienne de médecine d'urgence à revoir ses plans de sinistre et à se préparer pour des incidents éventuels dans sa propre région.

Introduction

Disaster response is often overlooked in medical school and residency curricula, but when disasters strike, the emergency medicine (EM) community man the front lines. Emergency physicians must be familiar with their hospital's disaster plan and be prepared to lead or participate in the disaster response.

The tornado at Pine Lake, Alta., on July 14, 2000, demonstrated the importance of disaster planning and the critical role played by the EM community. Physicians, paramedics and nurses were rapidly deployed to the disaster scene. They triaged, stabilized and transported scores of casualties, with support from regional emergency medical services (EMS), the Red Deer Regional Hospital[1] (RDRH) and Alberta's tertiary referral hospitals.

The Pine Lake disaster should serve as an impetus for the Canadian emergency medicine community to review their disaster plans and prepare for potential events in their own region.

Impact phase

At 1900 hours on July 14, 2000, an F3 tornado touched down upon the Green Acres campground at Pine Lake, Alberta, approximately 40 km southeast of Red Deer. The tragic event occurred on a busy summer weekend when the campground was packed. A total of 254 people were registered, and many registrants had visitors on site. The tornado touched down west of the campground, travelled rapidly east and remained on the ground for 30 minutes. Its 300 km/h winds uprooted trees and hurled people, vehicles and trailers into the air and into the nearby lake. The campsite

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was devastated. Trailers, campers and automobiles were destroyed. Casualties, debris and twisted wreckage were everywhere. Several people were thrown into the lake and forced to swim to shore. Before help could arrive, survivors initiated their own search and rescue — a common phenomenon during disasters.[2] Many survivors gathered their families and left the scene; this made subsequent casualty accounting difficult.

First response

First responders included the RCMP (Royal Canadian Mounted Police) and emergency medical services (EMS). When the magnitude of the destruction became apparent, calls for help were made to surrounding EMS agencies; this activated prearranged mutual-aid agreements. Paramedics on the scene rapidly notified the Shock Trauma Air Rescue Society (STARS) LINK centre and the Red Deer Regional Hospital, where casualties were already arriving by private vehicle. The STARS LINK centre, an aeromedical communications base, immediately dispatched its 2 medical helicopters and enacted its disaster plan, updating the RDRH and the larger Alberta referral hospitals in Edmonton and Calgary.

As darkness fell, the rain and wind picked up. Victims made their way to a casualty collection post (CCP), which had been established near the impact site. First responders set up a triage centre, a helipad and a morgue, and police cordoned off the area to establish an inner and outer perimeter. The RCMP secured the road leading to the campsite; traffic control was imperative to maintain emergency vehicle access to the CCP. Fire, rescue and EMS vehicles began arriving from nearby Innisfail and Red Deer; later, they came from as far away as Calgary. As the search-and-rescue effort grew, a long line of ambulances accumulated along the lake access road.

Many patients were sent by ambulance bus to local hospitals. Those with more severe injuries were transported to the RDRH. Stable "green" patients were taken to a local community centre and evaluated by EMS personnel. The Red Cross was activated to provide shelter and comfort. Most important, they took over the difficult task of accounting for survivors and answering information requests from family members.

Air support

Calgary city police provided their HAWKS helicopter, with infrared night cameras, to assist in the search for survivors, and STARS aeromedical teams flew in from their Calgary and Edmonton bases. Normally, STARS helicopters are staffed by 2 pilots, a critical care nurse and a paramedic, with on-line radio communication with a flight physician. On the night of the disaster, STARS Calgary carried a flight physician, who stayed on scene to help with triage and patient care at the CCP. The STARS flight physician worked tirelessly as a "master triager" until a group of Edmonton emergency physicians and EMS personnel arrived 2 hours later to provide relief. Meanwhile, the STARS helicopters shuttled patients from the scene to the Red Deer airport for stabilization and transfer to more definitive care facilities.

STARS Edmonton and Edmonton EMS sent 5 physicians to assist with scene response, to serve as transport physicians and to set up a staging centre at the Red Deer airport. The staging centre was established in an abandoned airplane hangar, using medical equipment borrowed from the RDRH and scavenged from airplanes. The M*A*S*H-like, mini-ER, staffed by paramedics, emergency physicians and a group of local respiratory therapists, administered blood transfusions, reduced fractures, intubated, and placed chest tubes.

Patients requiring care beyond what the RDRH would be able to provide were shuttled from the scene to the airport by ground or helicopter. In addition, victims arrived at the airport from the RDRH and from surrounding rural hospitals. At the airport staging centre, patients were re-triaged, stabilized and prepared for transport to hospitals in Edmonton or Calgary. Fixed-wing airplanes and aeromedical personnel from around Alberta rendezvoused at the Red Deer airport to help airlift the casualties.

The STARS LINK centre notified Edmonton and Calgary referral hospitals regarding the magnitude of the disaster. Later, as more accurate information became available, the LINK centre updated its casualty estimates so that the larger hospitals could downsize their response.

Regional responses

Smaller rural hospitals and community health centres in Three Hills, Stettler, Lacombe, Innisfail and Olds called in medical and nursing staff. Lacking advanced diagnostics, lab services and consultants, they treated the patients they could and stabilized others, who were then sent by ground ambulance to the RDRH or to the Red Deer airport staging centre. In Red Deer, the RDRH had activated its own disaster plan, calling in nurses, doctors and support staff in anticipation of 50 category "red" and 150 "yellow" patients. Their 23-bed ED was emptied, and 48 inpatient beds were cleared by discharging stable patients. This community hospital, lacking some surgical subspecialties, advised Edmonton and Calgary referral centres to prepare for surgical casualties.

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Referral centres

Based on information from Red Deer and from the STARS LINK centre, the Foothills Hospital in Calgary, and the Royal Alexandra and University hospitals in Edmonton activated their disaster plans. Because of regionalization, these are Alberta's only neuroscience and trauma centres, and they provide most of the province's critical care, pediatric and surgical subspecialty services. Operational cutbacks have left them functioning near capacity at all times, with little room to accommodate large numbers of critically ill patients. To prepare for incoming casualties, they called in surgical and critical care staff from home, transferred patients out of intensive care units and EDs and placed operating rooms on standby. In addition, they diverted ambulances to other local hospitals and discharged patients not requiring emergent care. Within an hour of impact, Edmonton and Calgary had both sent teams of physicians, nurses and paramedics to assist in triage, stabilization and transport of critically ill patients. An ambulance bus was sent from Edmonton with medical supplies and personnel to treat the "walking wounded."

Finale

As the number of new casualties at the disaster scene waned, physician teams at the CCP moved to the RDRH to offer whatever help they could. On-site search-and-rescue was terminated at 0300 hrs due to darkness and the inability to find any other casualties. Systematic searching continued in the morning and over the following days, but no further casualties were found on the ground or in the lake.

At the end of the first night, the official casualty list included 9 dead and over 130 injured. The number of fatalities rose to 12 when 3 more victims succumbed to their injuries in intensive care units around the province. Most major injuries were due to blunt head, torso or extremity trauma. Over the ensuing days, critical incident stress debriefing was offered to rescue workers and hospital personnel. Community leaders carried out a formal debriefing regarding the disaster response, so that planners could revise the disaster plan for future events.

Discussion

We learned several lessons from the Pine Lake disaster that will help us improve future disaster responses.

What went wrong?

The disaster response grew out of control.

A massive EMS response from neighbouring communities resulted in an excessive number of ambulances congregated at the campground. While many ambulances sat idle at the disaster site, local communities were left without ambulance coverage. In a nearby town, a critically ill patient had to be ventilated by bag-valve-mask overnight until an ambulance was available to transport the patient to Calgary. An organized dispatch system coordinating the various EMS services should have been able to balance the needs of the disaster scene with the needs of the surrounding communities.

Communication failed.

Communication is critical, and standard communication mechanisms tend to fail during disasters. In this situation, cellular phone communication was lost and information could not be passed from the disaster site to the receiving hospitals. To overcome this, information was relayed through airborne helicopters to the STARS LINK centre, which could teleconference with multiple sites, as needed. Unfortunately, while the STARS LINK centre was instrumental in disseminating information, not everyone recognized that it had accurate scene information; hence, most waited for other confirmation before taking action.

Scene information was also transmitted via the ambulance shuttle to receiving hospitals — a technique the Canadian military medical system practises even today, when telecommunication systems fail. A potential solution for future disasters is a mobile communications trailer that would be used as the on-site command and control post. A mobile communications vehicle was dispatched from Calgary, but arrived too late to be useful. In future, it might be wise to have such vehicles available on a regional basis. Problems existed between hospitals as well, where, because of poor communications protocols, information transfer from local hospitals to referral centres was slow and unreliable.

Regional receiving hospitals overreacted.

Because of poor communication and unreliable casualty estimates, Calgary and Edmonton referral hospitals fully activated their disaster plans. They cleared their EDs, vacated hospital beds, diverted city ambulances and called in physicians and nursing staff who were never utilized. When casualties arrived, they arrived in a staggered fashion, so hospital resources were not overwhelmed. In fact, because of the excessive staff call-in, there were times during the night when each trauma bay had 3 doctors and 3 nurses waiting for casualties who never came. With a disaster of this magnitude, a staged response is probably more appropriate, particularly given scene-to-hospital transport times of 1 to 2 hours. It might have been more prudent to call in limited extra staff and have others available on standby. A staged response also permits staff rotation and prevents staff fatigue if the disaster proves more serious or prolonged.[2]

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What went right?

Survivors helped each other.
As much as possible, survivors will rescue one another. The disaster literature shows that, in instances where ambulances were unavailable, survivors would transport each other to medical aid. So, although rapid search and rescue saves lives, much of the initial work is performed by survivors.[2]

Physicians functioned well at the site.
The role of physicians at disaster sites is controversial. During a mass casualty incident (MCI), identification of life-threatening injuries, stabilization, and rapid transport to definitive care are the priorities. Most physicians are not trained to rapidly identify life-threatening conditions and are poorly prepared to expedite transport; therefore, they may not function optimally on scene at an MCI. Bissell and colleagues[3] suggest that paramedics are ideal on-scene providers because their training is focused on rapid assessment and transport of critically ill patients. They also suggest that physicians can serve as "master triagers" on scene. Clearly, physicians can complement the triage initially performed by EMS personnel, and they may even be more able to direct patients to specific regional specialty units (e.g., burn or neuroscience centres). In addition, physicians can perform advanced skills that are beyond the usual scope of EMS providers (e.g., insertion of chest tubes or central lines). To be most effective in this environment, physicians should have prehospital experience and be familiar with the protocols, equipment, and the problems of field medicine.[3] This disaster demonstrated that a well trained EP could contribute to on-scene patient care.

Critical incident stress debriefing is important
Critical incident stress debriefing (CISD) should be offered to survivors and rescue workers. Defusing sessions can be conducted at the survivor centres soon after their arrival. For mental health reasons, rescue workers require early defusing with follow-up debriefing, although controversy exists as to whether CISD should be mandatory.[4]

Regionalization changes everything
Regionalization, a national phenomenon, has made previous disaster plans obsolete. Responders and receiving centres may have changed. People with critical roles may have changed positions or moved to other hospital sites. Fortunately, the Red Deer plan had been recently updated to reflect regionalization. Many other Canadian disaster plans have not.

Conclusion

Disasters can occur anywhere. Thoughtful planning and regular updating and re-evaluation of disaster plans are critical to the improvement of disaster response. The principles of disaster medicine should be taught to medical students, residents and practising physicians, who all have a role in planning the medical response to future disasters.

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