

Coordination of Emergency Medical Services for a Major Road Traffic Accident on a Swiss Suburban Highway

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Abstract

On 9th April 2008 at 2:14 p.m., on the highway between Lausanne and Vevey in western Switzerland, there was a 72-car pileup including five trucks that caused one death and injured 26 others. The relatively light toll was attributed to reduced vehicular speeds on account of foggy weather, together with the quick actions and effectiveness of the first responders and the excellent collaboration between the various rescue groups (medical rescue services, fire and police departments). For the first time, we used an innovative on-site medical command and control system, based on a binomial team. Two hours after the accident, the last of the injured had been evacuated and first aid on the site had ended. This article describes how the Emergency Medical Services from the State of Vaud, Switzerland, handled the situation and how the binomial team is structured.

Key Words

Traffic injuries · Highway · Emergency medical services · Disaster command and control

Eur J Trauma Emerg Surg 2009;35:265–70

DOI 10.1007/s00068-009-8231-0

Introduction

The highway between Lausanne and Vevey travels along the Lake of Geneva at an altitude of 600 m. It

was built in the early 1970s and is a two-lane highway, including an emergency lane in each direction. Traffic is typically heavy, with an average of more than 60,000 cars per day. This region is often in a dense fog. A similar accident on the same stretch of highway took place on 20th February 1999 and involved 45 vehicles. The section of the highway where the accident occurred is mainly composed of viaducts and is, therefore, inaccessible using the shoulder of the road. Both helicopter landings as well as the set up of an advanced medical post can only be done directly on the road. Due to the topography of the area, ambulances have to access the accident site going both in the direction of traffic, as well as against traffic. The contra lateral road can also be used to gain access to the site. That was the case on this occasion (Figure 1).

On 9th April at 2:15 p.m., the Emergency Medical Services (144) was alerted by the police after the latter had received a call from an eyewitness. The information was immediately confirmed by a second witness, an ambulance driver who was in the accident, and who called 144 on his cell phone. There was a dense fog, the temperature was approximately 10°C, there was a light wind, and it was raining. Visibility was approximately 25 m. The accident site stretched over an area of 200 m and was comprised of a tangle of cars and trucks (Figure 2). Reduced vehicular speed no doubt kept the injuries light, but slow speed was also (together with poor visibility) the principal cause of the accident. Drivers who were surprised when they came upon

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Sources of support: none. Competing interests: none declared.

Received: December 3, 2008; revision accepted: May 11, 2009;
Published Online: June 1, 2009



Figure 1. Use of the contra lateral road to gain access to the site.



Figure 2. A tangle of cars and trucks.

slow-moving traffic in the fog caused the first cars to collide, and this was followed by a multi-car pileup.

Materials and Methods

We retrospectively collected all of the data concerning the number of victims treated at the site and at the involved hospitals, as well as the logistics and dedicated structures, reported by the Emergency Medical Services, the Health Authority of the State, and the police and fire departments.

In the State of Vaud (670,00 inhabitants), emergency medical resources are coordinated by the 144 call center. The police and fire departments each have their own dispatch center. The 144 dispatchers are either trained paramedics or nurses. The 144 call center consists of the logistic head of all medical rescue operations in the entire state, regardless of the type.

Since 2008, the medical command and control system for rescue operations on site is based on a binomial setup comprised of one head rescue doctor and one head rescue paramedic, both trained for disaster medicine (Figure 3). This team can be mobilized 24/7 for any major event and is responsible for coordinating the rescue efforts at the site of the catastrophe. In principle, this team is mobilized as soon as the number of patients exceeds ten or if an accident requires more than five rescue teams (ambulances, helicopters, medical response teams¹).

The 144 center can dispatch about 20 ambulances and eight medical response teams throughout the

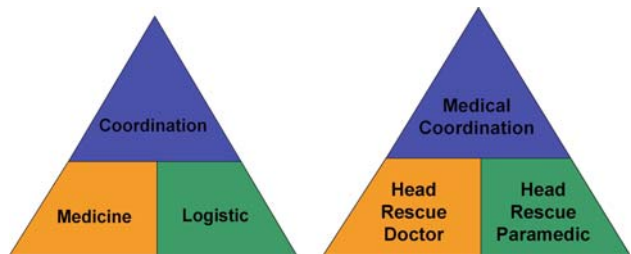


Figure 3. The on-site medical command and control system.

entire state, in addition to one medical helicopter based in Lausanne. In case of a disaster, an advanced medical post (Figure 4) can also be deployed. This structure is staffed with paramedics and doctors who are responsible for attending victims awaiting evacuation. Finally, if necessary, 144 can also ask for resources from other states (ambulances, medical response teams, and helicopters).

Results

Emergency Medical Services Response to the Accident

At 2:15 p.m., the 144 center was alerted of a major accident on the highway and immediately dispatched three ambulances and the medical command and control team. At 2:21 p.m., the medical response teams from Lausanne and Vevey were dispatched, as well as the advanced medical post (AMP).

At 2:51 p.m., according to the Swiss prehospital strategy, an initial assessment (pretriage) by the first paramedics on the scene reported one death and 20 injured (including four severe), many of them being trapped in their cars. In total, 16 ambulances, two medical response teams, the helicopter crew, the AMP,

¹ Those teams are composed of one emergency doctor and one paramedic. They are complementary to the ambulance when a situation needs medical support. Their vehicle does not allow the transportation of patients.



Figure 4. The advanced medical post.



Figure 5. Mobile EMS command post.

and the medical command and control team were dispatched by the 144 center (Table 1). On this occasion, 144 also dispatched the mobile EMS command post

Table 1. Pre-hospital medical resources alerted.

| Units | Size and type | Distance (km) from the scene |
|----------------------------------|-------------------------------------|------------------------------|
| Ambulances | | |
| Ambulance 1 | 2 paramedics | 9 |
| Ambulance 2 | 2 paramedics | 9 |
| Ambulance 3 | 2 paramedics | 9 |
| Ambulance 4 | 2 paramedics | 8 |
| Ambulance 5 | 2 paramedics | 8 |
| Ambulance 6 | 2 paramedics | 9 |
| Ambulance 7 | 2 paramedics | 36 |
| Ambulance 8 | 2 paramedics | 8 |
| Ambulance 9 | 2 paramedics | 9 |
| Ambulance 10 | 2 paramedics | 8 |
| Ambulance 11 | 2 paramedics | 24 |
| Ambulance 12 | 2 paramedics | 9 |
| Ambulance 13 | 2 paramedics | 8 |
| Ambulance 14 | 2 paramedics | 43 |
| Ambulance 15 | 2 paramedics | 52 |
| Ambulance 16 | 2 paramedics | 9 |
| Ambulance 17 | 2 paramedics | 34 |
| Ambulance 18 | 2 paramedics | 8 |
| Mobile EMS command post | 1 dispatcher, 1 paramedic | 9 |
| Helicopter REGA | 1 pilot, 1 paramedic, 1 doctor | 8 |
| Medical response team 1 | 1 paramedic, 2 doctors | 9 |
| Medical response team 2 | 1 paramedic, 2 doctors | 9 |
| Medical command and control team | 1 paramedic, 1 doctor | 9 |
| Advanced medical post | 2 tents, 25 (nurses/paramedics) | 9 |
| Total | 74 health care professionals | |



Figure 6. Mobile EMS command post.

(Figures 5 and 6), equipped with all communication devices (radios, mobile phone, computers) and staffed with a 144 dispatcher, allowing medical regulation directly from the site. Unfavorable weather conditions prevented the use of the helicopter and aerial reconnaissance of the site. Nevertheless, the helicopter team (one physician and one paramedic) was dispatched by land to participate in the on-site triage.

Hospitals Response to the Accident

The state of Vaud has one university hospital which functions as a level 1 trauma center and seven regional hospitals. In accordance with present procedures, the regional hospitals closest to the accident were notified of the event by 144 and were asked to receive the injured. Inventories of available beds among all emergency rooms, intensive care units, and burn centers were taken (Table 2). At 3:25 p.m., or 70 min after the accident was first reported, 144 was able to inform the medical command and control team of the bed availability at the hospitals closest to the accident site in order to optimize care dispatching of the victims. At the sound of the first

Table 2. Hospital resources available.

| Hospital | Distance from the accident (km) | Total beds available | ICU beds available | Trauma center (yes/no) | Burn center (yes/no) | Disaster plan activated (yes/no) |
|------------------------------|---------------------------------|----------------------|--------------------|------------------------|----------------------|----------------------------------|
| CHUV (trauma center) | 8 | 28 | 3 | Yes | Yes | Yes |
| Paediatric Hospital Lausanne | 12 | 10 | 0 | No | No | No |
| Morges | 24 | 15 | 1 | No | No | No |
| Montreux | 24 | 4 | 1 | No | No | No |
| St-Loup | 28 | 4 | 2 | No | No | No |
| Vevey (paediatrics) | 20 | 4 | 0 | No | No | No |
| Payerne | 41 | Not alerted | Not alerted | No | No | No |
| Yverdon | 41 | Not alerted | Not alerted | No | No | No |
| Nyon | 52 | Not alerted | Not alerted | No | No | No |

Table 3. Hospital load.

| Hospital | Out-patients | In-patients ward | In-patients ICU | Surgery |
|------------------------------|--------------|------------------|-----------------|---------|
| CHUV (trauma center) | 10 | 2 | 0 | 2 |
| Paediatric hospital Lausanne | 2 | 0 | 0 | 0 |
| Morges | 5 | 1 | 0 | 0 |
| Montreux | 2 | 3 | 0 | 0 |
| St-Loup | 1 | 0 | 0 | 0 |
| Vevey (paediatrics) | 0 | 0 | 0 | 0 |
| Payerne | 0 | 0 | 0 | 0 |
| Yverdon | 0 | 0 | 0 | 0 |
| Nyon | 0 | 0 | 0 | 0 |
| Total | 20 | 6 | 0 | 2 |

alarm, many hospitals freed up their emergency rooms by moving patients to the floors, halted elective surgeries by finishing ongoing operations and retained personnel who had ended their regular shifts.

Patients were transported to five different hospitals. The regional hospitals received those with the least severe injuries. The university hospital (CHUV) was, at first, reserved for victims with the most severe injuries. As there were no cases of major multiple trauma, the CHUV finally received a total of 12 patients with moderate injuries, and in two waves. No secondary transfers were done from the regional hospitals, which attests that the on-site triage was entirely appropriate. None of the hospitals receiving accident victims showed signs of patient overload or any technical dysfunction related to the influx of the injured. The homogeneous distribution of patients amongst the five hospitals probably contributed to this (Table 3).

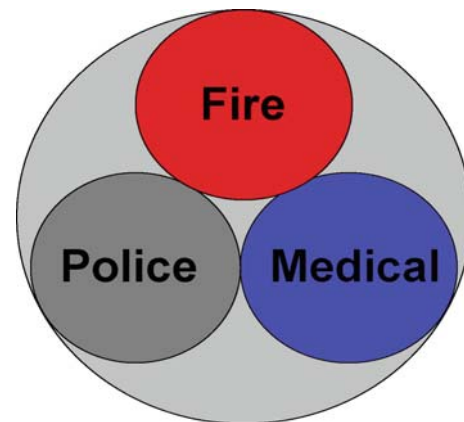


Figure 7. The tripartite system, reuniting the medical command and control team and the police and fire departments.

Central Coordination and Command on the Site

The activities at the accident site were organized around a tripartite system, reuniting the medical command and control team and the police and fire departments (Figure 7). Coordinated reports every 30 min assured a regular exchange of information. The medical command and control team was backed up by the mobile EMS command post. The coordination of emergency rescue services, therefore, operated flawlessly at the state level. The 144 center was essential as back-up support with the on-site command post. This was possible thanks to the recruitment of three additional 144 dispatchers to supplement the two already on duty that day. Besides this, it also kept the centers’ ability to manage both the emergency as well as all normal daily operations for the whole state.

Communication Systems

The on-site communication between the various health care professionals was assured mainly by radio on a

dedicated channel for ambulances and medical personnel. The police and firemen had their own separate, dedicated channel. Because of the large number of action plans implemented, radio communication channels were quickly saturated, thus, limiting the effectiveness of those communications. Cell phone networks were only briefly saturated and served, in many instances, as subsidiary modes of communication. 'Dispatch riders' were used sporadically to transmit information, in particular between the accident site and the on-site command post.

Total Number and Severity of Injuries

With the exception of one victim who died at the scene, the 27 other victims suffered only minor injuries. The initial pretriage conducted by the first team of paramedics on the scene reported one death and 20 injured, including four serious. This first report overestimated the severity of injuries and slightly underestimated the number of injured. This anomaly is explained by a relatively high number of victims trapped in the cars, but who were, in the end, free from traumatic injuries. All injuries were due to direct physical trauma. The presence in the pileup of a natural gas vehicle was discovered later.

All 47 people involved but uninjured were medically evaluated on the site and rapidly evacuated by bus to the state central police station 9 km away. A second clinical examination was organized in the local police stations by a medical team, which brought to light six additional victims requiring medical attention for minor trauma. A team of five mental health professionals offered, if desired, psychological support at the state police station where the unharmed were transported. The media assisted indirectly with the resiliency of the operation by focusing on the positive reactions of those involved who spontaneously offered help and their vehicle as shelter for the injured. The last of the injured were evacuated at 4:35 p.m. or 140 min following the accident.

Discussion

The 144 center reacted rapidly and dispatched the first responders in a timely manner. An inventory of available beds at regional hospitals was done rapidly and there were a sufficient number of ambulances on site. Pre-triage was highly effective, with an initial assessment 15 min following the accident, which turned out to be close to the final assessment. There was no need to provide any urgent care (intubations, thoracic drainages), which allowed for the majority of

patients to be evacuated without having to be treated at the site. The low ISS scores of patients (all below 15), in addition to the quick arrival of many transport vehicles, allowed for the quick evacuation of patients, without the need for a true triage.

The medical command and control binomial team functioned extremely well. The specific skills of one physician and one paramedic both trained in the management of this type of disaster proved to complement one another perfectly and were, thus, indispensable to the task at hand. The presence of the mobile EMS command post with a dispatcher was of great help for the medical binomial team, relieving both the head paramedic and head doctor of time-consuming communications with different partners.

Excellent collaboration existed between the various partners (police, firemen, and health care professionals) on site with frequent coordination meetings.

The communications and the flow of information to and from the hospitals were the area which proved to be the most unsatisfactory during the management of this major accident. It is necessary to have a dedicated mode of communication for the hospitals so that they can remain regularly informed about the evolving situation at the scene of the accident. Some hospitals far from the scene did not receive any information from the 144 center because it was assumed that they would not be receiving any of the victims. On the other hand, those hospitals that were notified would have liked to receive additional information about the accident.

Finally, the quality of the radio messages showed that many of the health care professionals involved lacked proper training in the use of this mode of communication.

Conclusion

In all, over 170 rescuers (police, firemen, and health care professionals) were dispatched to the site.

It is important to highlight that, with such a large number of vehicles involved, the toll could have been much greater. Chance does not stop there: if the accident had happened outside of working hours, it would not have been possible to get as many reinforcements and in such a timely manner for the 144 center, nor as many ambulances or physicians on the ground.

It is also of note that, because of difficulties in accessing the accident site and due to the rapid deployment of the emergency crews, the rescue efforts were not hindered by idle onlookers, families, or by the press. The topography also allowed for maintaining

control over the group of victims. In fact, no victim could have left the site on his/her own, and none admitted himself/herself directly to a hospital. This allowed for an optimal use of the local hospitals and avoided an influx of spontaneous consultations.

The excellent evolution of the rescue operation at this accident site demonstrates the importance of teaching the basic elements of disaster medicine to all rescue personnel, as well as regular training in command and control strategies. This assures that all rescue teams speak the same language and that the leaders of the rescue missions have the tools available needed to 'organize the chaos.'

Simulations at the 144 center, practical exercises on the ground or in the hospitals, in addition to medical training for disasters, lie, without a doubt, behind the success of this rescue operation.

Acknowledgments

The authors would like to acknowledge Danielle Wyss-Sylvest for the proofreading and final translation.

Conflict of interest statement

The authors declare that there is no actual or potential conflict of interest in relation to this article.

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