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Rural Disaster Management

Lessons Learned in Mass Transit Rescue

by Ruth E. Uphold, MD, Michael O'Keefe, EMT-D and Elizabeth A. Schaeffer, RN

With multi-casualty incidents (MCIs) on the increase, EMS systems and hospitals are expected to be trained and ready to act. As with the case in the Amtrak train accident in Williston, Vermont, which involved more than 150 victims, MCIs are frequently the result of mass transit accidents or construction or engineering mishaps. The last major train accident within the state occurred in 1887, so not surprisingly, none of the ambulance personnel had any prior experience with train rescue. It is important that lessons learned from an accident such as this be shared so that others can benefit from the experience. We describe here the unique problems posed by railroad cars and a rural accident site. We conclude that certain specialized rescue tasks are performed well even though the individuals have never been drilled in disaster preparedness. EMS personnel sufficiently familiar with a disaster plan are able to adhere to it in principle, while remaining flexible in adapting it to specific problems.

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On July 7, 1984, shortly before 7 a.m., a 12-car, two-engine Amtrak passenger train was traveling north through the western portion of Vermont between Williston and Essex Junction. At 6:51 a.m. the train hit a section of track crossing a run-off culvert which had been eroded away by the previous night's torrential rainfall. The first two cars and the two engines traveled across the flood-created ravine and four cars plunged into the two- to four-foot deep water and mud. There were 278 people aboard the train, of whom 262 were passengers.

Williston, Vermont, where the derailment occurred, is a rural town of about 4,000 located on the outskirts of Burlington. The area is served by 11 emergency ambulance rescue squads (all but one are volunteer), two first response squads and one private nonemergency service. Average call volume per squad is approximately 200 to 400 per year. Almost all squads provide at least some service at the EMT-Intermediate level and just about every call has at least one EMT-Basic which includes certification to use antishock trousers. There are no active paramedics in the district, although two squads provide defibrillation without drugs by written protocol. Each squad conducts frequent continuing education sessions for its own members which are supplemented by formal training programs sponsored by the district. There are approximately 250 active squad members in the district, of whom at least 90 percent are volunteer.

There are two hospitals in the district—Fanny Allen Hospital, a community hospital with 100 beds and the Medical Center Hospital of Vermont (MCHV), a referral center with 450 beds. There is a coordinated dispatch center in MCHV's emergency department.

Access to the accident site was a major problem. The first report was only an approximation, so ambulances approached from two directions. The best access involved a quarter-mile walk through a heavily wooded area. A path had to be cleared before any patients could be carried out this way. The initial approach involved driving on the railroad bed, crossing a trestle, and walking an additional 300 yards. Several patients were evacuated over this route by means of a railroad work car before the ambulance staging area was set up. Two significant factors in the rescue operation were the terrain and the distance over which patients had to be moved before they could be loaded onto ambulances or helicopters. A road had to be constructed to remove the train passengers, as well as to enable necessary heavy duty extrication equipment to reach the site. To this end, numerous construction companies volunteered their services (see Table 1 for equipment

and accomplishments involved.

Coordination of rescue efforts was complicated by the geography of the accident site. A waist deep river flowed under the four toppled railroad cars and separated the first four cars (which successfully made it over the trestle) from the rest of the train. Because of the difficulty in getting from one side of the train to the other, two command posts were established. This was not a contingency in the written disaster plan, nor had it been rehearsed prior to the Amtrak accident, but it resulted from seeing a problem and being flexible enough to stray from the written plan as needed. Most patients from the forward cars were ambulatory and walked out. A majority of the patients from the rear cars were also uninjured or walking wounded, while patients from the cars in the ravine required extrication. Shortly after the command posts were established, a treatment station was set up next to the ambulance staging area where all patients were taken before being treated. This area also served as a focal point for media representatives.

Estimating the number of seriously injured patients was quite difficult, as there was no immediate way to get into the railroad cars on the bottom of the ravine. The train manifest only included the passengers with reserved seats and it could not be immediately located. The passenger list, which was with a conductor who had been critically (and ultimately fatally) injured was also unavailable. When the manifest was found, it had fewer names than passengers already identified.

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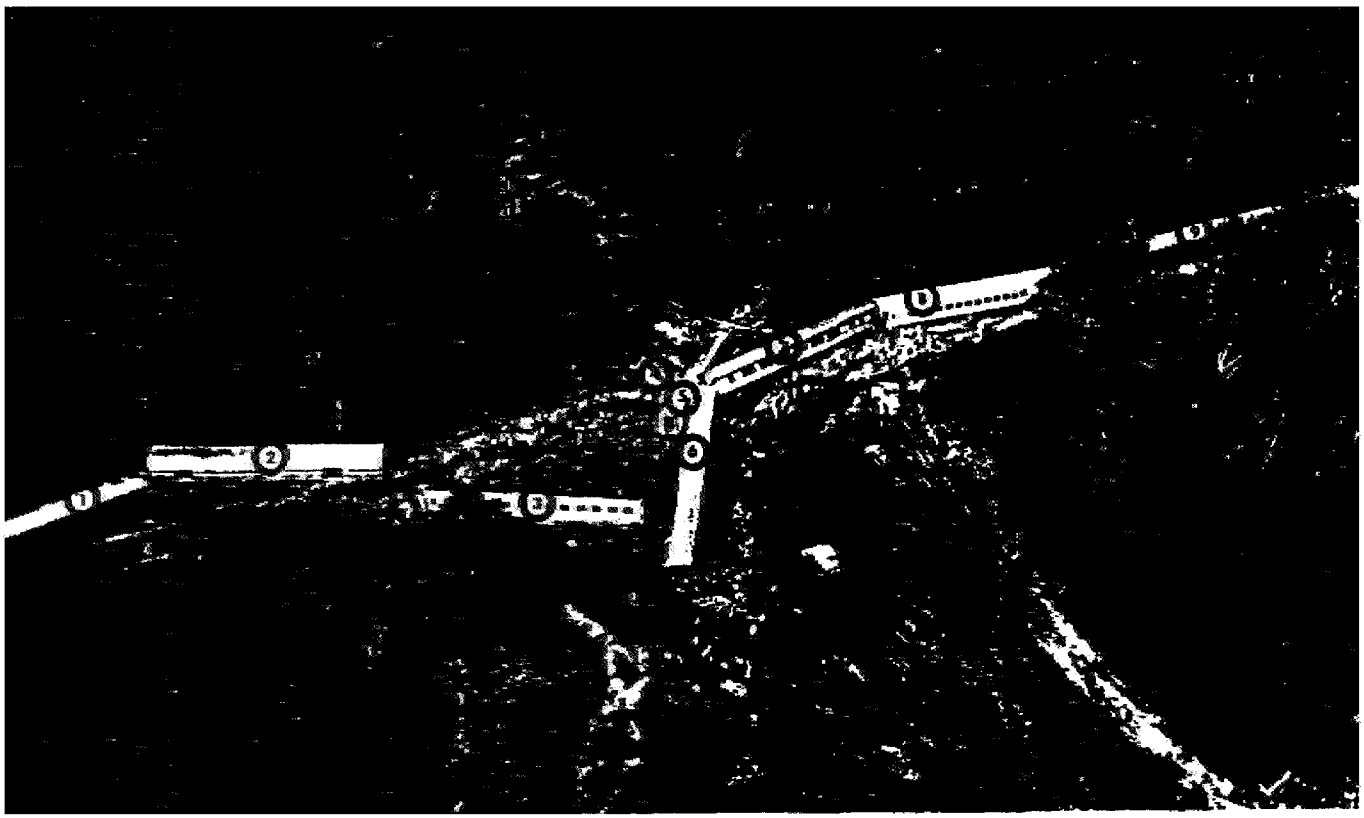
The slumber car on the bottom of the pile of twisted wreckage was damaged on both ends. It had a maximum capacity of 40 and it seemed probable that all, if any, survivors would be seriously injured. This meant that the hospital ambulance personnel and support services had to remain on alert until this railroad car could be searched. Because the slumber car could not be entered from either end, access was gained by using tools to enter the roof on the northern side and the floor on the southern side. (The ideal point of attack would have been through windows which are easily removed, but they were blocked by the water and mud underneath and by the food service car resting on top.) Numerous heavy duty tools were used on both sides. The roof was somewhat easier to enter but there was considerable rubble and debris inside, which hampered efforts to reach the passengers. Partitions between berths had to be broken through, plumbing fixtures removed and various other obstructions dealt with. The floor of the car proved more difficult. At a railroad extrication class conducted by Amtrak several weeks before, the firefighters who attended were told that cutting through the floor would be next to impossible. With the help of rescue saws (and 20 blades) and torches, the task proved time-consuming but not impossible.

Due to the cars' extremely strong construction, it was clear that an inordinate amount of time might be spent gaining access to areas in the car that held no passengers. After removing all the passengers that could be seen or heard, all machinery was turned off and EMTs knocked on the walls of the car, then listened with stethoscopes for any response. Hearing none, it was decided that any remaining victims were likely dead and plans were made to rip off the top of the car. After eight hours all surviving passengers had been extricated from the slumber car. Close attention



1 Second Engine 2 Baggage Car 3 Passenger Car 4 Sleeping Car 5 Dining Car 6-9 Passenger Cars

Numerous rescue, military, police and construction crews were involved Wide World Photos.

Table I: Activities of Construction Companies

Accomplishments

2 Acres woodland converted to road
500 ft earthen dam built (8 ft high, 20 ft wide)
2,000 cubic yards fill moved
12-14,000 cubic yards cut and fill

Equipment

CRANES

125 ton link belt
65 ton P and H
20 ton P and H
20 ton Omega
15 ton Grove

TRUCKS AND OTHER

24 dump trucks (with 74 on standby)
2 traxcavators
2 bucket loaders
3 tractor trailers
3 welding trucks
3 rigging and other trucks
4 bulldozers
1 backhoe
1 backloader

LIGHTS

3 generators
12 scene illumination lights

was paid to safety at all times throughout the extrication process. As much as possible, rescue workers not directly involved were kept out of the immediate area of the wreck. Officials from Amtrak and a local railroad showed up early in the operation and were consulted for better or safer means to work.

Of the 278 individuals on the train, 145 were treated in one of the two local hospitals and 27 patients were admitted. Only one victim was taken directly to the operating room and he subsequently expired. Of the five fatalities, four were dead on the scene and they were all in the slumber car. The remaining fatality was crushed between two cars and then thrown or dropped into the river. He subsequently arrived at the hospital in shock and died in the OR of severe pelvic fractures and massive retroperitoneal hemorrhage. Fatal injuries are listed in Table II

Eighteen patients were admitted to the Medical Center Hospital of Vermont (MCHV), 15 from the Emergency Department and three transferred from the local private hospital. See Table III. Except for the patients trapped in the slumber car or transferred from the other hospital, all the patients requiring admission arrived in the ED betwen 8:15 and 10:00 a.m. Eleven of the 15 admitted were among the first 26 patients arriving at the ER. The last ambulatory patient arrived at 4:30 p.m. Before the path was opened in the woods it was easier to mobilize the less seriously injured; despite this, the established triage system prioritized transport relatively well.

Standard protocol for patients requiring neurosurgical attention is that they be taken directly to the MCHV. Two of the 53 patients taken initially to the local hospital represent errors in triage; one had a spinal injury, the other had severe head injury. These two patients were evacuated before the ambulance staging area was established with a transport officer in command.

The last survivor was extricated from the slumber car at 2:52 p.m., nearly eight hours after the accident. However, it was not until 1 a.m. that night that the last victim was extricated and 1:29 a.m. when the rescue efforts were terminated. See Table IV for pertinent times.

Several other observations can be made. Some merely confirm what others have reported but are significant enough to warrant reinforcement, while others surprised us and may assist others in their planning and preparations for multiple casualty incidents.

Although the psychological effects of multiple casualty incidents on the rescuers themselves has been widely discussed, it was brought home with surprising force in a session two days after the derailment. It was intended to be a critique of the prehospital operations, but was attended by several hundred rescue workers and turned instead into a emotional ventilation session,.

Table 2: Fatalities

1. 60 y/o male
Pelvic fractures. Retroperitoneal hemorrhage. Rib fracture: Shattered lower extremity.

2. 35 y/o male*
Severe head injury with basilar skull fracture, cerebral contusion and laceration. Hemothorax. Rib fractures.

3. 77 y/o male*
Blunt chest injury with pulmonary contusion and edema. Fractured ribs. Fractured pelvis.

4. 39 y/o male*
Compression of chest causing Asphyxia. Fractured ribs. Pulmonary laceration, contusion. Fracture tibia/fibula.

5. 63 y/o female*
Basilar skull fracture with subarachnoid hemorrhage. Multiple extremity fractures. Rib fracture.

*Dead at the scene

Table 3: Patient Care

Patient #	Age	Sex	Arrival at E.D.	Injuries	Discharge date
1	78	M	8:15	Closed head injury, scalp avulsion	7/14
3	69	F	8 25	Aspiration pneumonia	7/12
4	33	F	8:45	Scalp avulsion, fractured ribs	7/12
6	55	M	8:50	CHI, scalp laceration	7/13
8	60	M	8:45	Pelvic fracture with hemorrhage	fatal
15	47	M	9:10	Blunt head injury	7/8
16	20	F	9:10	Crushed thigh, ankle sprain	7/10
18	50	F	9.15	R/O leg fracture	7/8
24	22	F	9.25	CHI	7/7
25	45	F	9:30	CHI	7/8
26	30	F	9:33	CHI	7/10
**	49	M	9:44	Subluxtion T7-8 with paresis	7/12*
39	35	F	9 52	C spine sprain	7/8
43	49	F	10 00	Chest pain, ventricular ectopy	7/8
86	31	M	14.50	Basilar skull fracture, Myoglobinuria	7/12*
88	77	F	15:25	Crush injury with compartment syndrome and Myoglobinuria, Second degree burns—3% body surface	7/13
**	34	M	15:32	Skull fracture, cerebral contusion	7/13
**	32	M	7/9	Fracture-dislocation of hip, concussion, rib fracture	8/14*

**Transfer from other hospital
*Transfer to other hospital

which was important but which hampered efforts to evaluate the operations objectively When this need for validation of a shared experience became apparent, a counseling session was set up a week or two later, but only one person attended. Shortly thereafter, a critique was held at which many constructive comments were made. It must be strongly emphasized that even in a well run, relatively bloodless mass casualty incident, with a limited number of critically injured patients, emotional needs of rescuers must be met as soon as possible after the incident in order to prevent longstanding problems.

With any extended operation, fatigue becomes a major problem. Many rescuers stayed after most of the work was done in the daytime and remained on standby at the scene while the final salvage operations continued into the night. By this time there were other qualified rescue workers who could have relieved them. No injuries occurred because of fatigue, but members of the Command Post must be aware of this problem and be prepared to send rescuers (including possibly themselves) home when there are other qualified people at the scene. The only rescuer injured, in fact, was a firefighter/EMT who had remained with a passenger inside the very hot and humid slumber car because the patient needed constant reassurance and physical contact. The rescuer's dehydration responded well to intravenous fluids.

With any operation of this nature, the question of the usefulness of drills arises. In this regard, we suggest that drills assist in preparing for mass disasters only insofar as they accomplish two things: first, they keep all agencies and personnel up-to-date on the specifics of the roles to be filled both inside and outside of the Command Post; and second, they help provide for cooperative interaction among different organizations within the same field and among the different agencies that will be involved. In our experience, one or two drills annually do not provide enough opportunity to experience the latter; instead, we attribute the cooperation at the scene more to the frequent use of mutual aid and back-up agreements for smaller incidents.

Burlington has no rescue helicopter service. However, the governor mobilized the Vermont Air National Guard who supplied several helicopters and pilots. In retrospect, we were quite surprised to learn that use of these helicopters resulted in little or no reduction in transport time. This probably was due to the relatively short distance involve and the need to shuttle patients from th landing pad, half a mile away, to th emergency department by ambulance

Two conclusions can be drawn fror this Amtrak disaster. First, the non-EM rescue support teams performed ver well despite lack of any prior forma training or drilling; a road was con structed through the woods and down a ravine in record time; the river wa dammed and the bed diverted aroun the accident site to prevent furthe flooding in the event of more rain; a huge crane was dismantled from a site 30 miles away, transported to the scene and reassembled in order to move the piled railroad cars (a task that normally takes two days); and finally the National Guard provided helicopters and pilots to assist in transport. The key factor in these accomplishments was knowledge of the local equipment and manpower available and how to mobilize this force.

Second, EMS personnel need familiarity with disaster rescue in order to appropriately triage and transport patients in an orderly fashion. Any plan of operations should be explicit in describing overall command, communications, triage, and transport, but remain flexible enough to be adapted to specific rescue missions. □

Table 4: Pertinent Times

0651 Derailment occurs
0659 Accident is confirmed and dispatching begins
0720 First ambulance reaches scene
0756 First patient leaves scene by ambulance
0815 First patient arrives at M.C.H.V. Emergency Department
0842 Most seriously injured patient leaves scene
1237 Slumber car patients #1 and #2 en route
1452 Last live patient removed from slumber car
0129 EMS operations concluded

Agencies Involved

17 ambulance rescue squads
2 first response squads
7 heavy rescue (extrication) squads
12 fire departments
3 police departments (2 local + state police)
6 construction companies
8 private restaurants and food stores
Air National Guard helicopters
American Red Cross
Civil Defense