



Fire Fighter Dies as a Result of a Cardiac Arrest During a Training Drill - West Virginia

SUMMARY

On September 30, 1998, a 56-year-old male volunteer fire chief collapsed while monitoring pumper truck operations during a training drill conducted at a local nursing home. The fire chief was wearing full turnout gear but no self-contained breathing apparatus (SCBA). He was not engaged in strenuous activities at the time, but it was a hot and humid day. According to witnesses, the fire chief showed no signs of distress when talking briefly with fire fighters during the drill. Later he was seen walking to the rear of the pumper (without his bunker coat). Approximately 5 minutes later, he was seen walking around back toward the pumper panel when he suddenly collapsed.

Within 2 minutes, on-scene emergency rescue personnel who were also participating in the fire drill reached the unconscious chief and initiated cardiopulmonary resuscitation (CPR) followed by advanced cardiac life support (ACLS) including cardiac defibrillations, external pacing, endotracheal intubation, oxygen, and multiple doses of medications. ACLS continued during the 1-hour trip to the hospital; however, after a brief initial weak heart beat during pacing, resuscitation efforts were unsuccessful, and the patient never regained consciousness. At the hospital emergency room, an initial assessment showed fixed dilated pupils and no cardiac electrical activity, and the patient was pronounced dead. The death certificate stated acute coronary insufficiency as the cause of death; no autopsy was done.

The following recommendations address health and safety issues in general. It cannot be determined, however, whether these recommendations could have prevented the sudden cardiac arrest and subsequent death of this fire chief. These

recommendations rely on a two-pronged strategy proposed by other agencies for reducing the risk of on-duty heart attacks and cardiac arrests among fire fighters. This strategy consists of (1) screening to identify and subsequently rehabilitate high-risk individuals; and (2) encouraging increased individual physical capacity. Steps that could be taken to accomplish these ends include

- *Fire Fighters should have annual medical evaluations to determine their medical ability to perform duties without presenting a significant risk to the safety and health of themselves or others.*
- *Provide fire fighters with medical evaluations to wear self-contained breathing apparatus (SCBA).*
- *Perform an autopsy on all fire fighters who were fatally injured while on duty.*
- *Reduce risk factors for cardiovascular disease and improve cardiovascular capacity by implementing a wellness/fitness program for fire fighters.*

The **Fire Fighter Fatality Investigation and Prevention Program** is conducted by the National Institute for Occupational Safety and Health (NIOSH). The purpose of the program is to determine factors that cause or contribute to fire fighter deaths suffered in the line of duty. Identification of causal and contributing factors enable researchers and safety specialists to develop strategies for preventing future similar incidents. To request additional copies of this report (specify the case number shown in the shield above), other fatality investigation reports, or further information, visit the Program Website at:

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INTRODUCTION & METHODS

On September 30, 1998, a 56-year-old male volunteer fire chief collapsed in cardiac arrest while monitoring pumper operations during a training drill. Despite immediate CPR and ACLS administered by the ambulance service who were on the scene at the time, the fire chief died. The National Institute for Occupational Safety and Health (NIOSH) was notified of this fatality on October 5, 1998. On January 22, 1999, NIOSH telephoned the affected Fire Department to initiate an investigation. On February 8, 1999, an investigator from the NIOSH Fire Fighter Fatality Investigation Team traveled to West Virginia to conduct an on-site investigation of the incident.

During the investigation NIOSH personnel met with and interviewed the

- Fire Department Chief, the Assistant Chief, and the Fire Department President
- Personnel from the involved Fire Department
- Personnel from a neighboring Fire Department involved in the training drill
- Ambulance personnel responding to this incident
- Family members

During the site visit NIOSH personnel also reviewed

- Existing Fire Department investigative records, including incident reports, co-worker statements, dispatch records, and the victim's training records
- Fire Department policies and operating procedures
- Death certificate of the deceased

- Ambulance dispatch records and response form
- Hospital records related to this incident

NIOSH personnel also visited the training drill scene and later talked by telephone with the victim's personal physician.

INVESTIGATIVE RESULTS

Training Drill Activities. On September 30, 1998, at 1830 hours, fire and rescue units gathered at a local nursing home to conduct a fire suppression and joint mass-casualty rescue drill. This exercise was planned at the request of the nursing home facility and involved seven members of the volunteer Fire Department of the victim, two other local volunteer Fire Departments, and several rescue squads, for a total of about 40 people. The victim drove a pumper truck to the drill scene and stationed it on the side of the road fronting the nursing home. A 1,500-gallon drop tank was placed near the rear of the pumper, and to simulate the needed fire flow, water in the drop tank was pumped via a 2 1/2-inch handline into an adjacent field. Tanker trucks from the other companies brought water from a nearby pond to keep the drop tank filled. The victim manned the pumper truck's control panel, which did not involve heavy exertion, in this process. He wore full turnout gear but no SCBA. The rescue trucks were stationed approximately 50 yards away.

The training drill was proceeding without mishap, although the fire fighters noted being hot because it was a hot and humid day. The victim had talked briefly with the tanker truck crews during their shuttle operations and did not report any symptoms suggestive of a medical problem. At approximately 1910 hours, the victim (without his bunker jacket or helmet) walked from the pumper panel to the drop tank area. After a couple of minutes, he turned toward the panel but suddenly collapsed. This was



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witnessed by the tanker crew, who quickly went to him, found him unconscious, and ran to get rescue crew assistance. The rescue crew, including a physician's assistant and a paramedic, reached the victim at 1915 hours, found the victim in full cardiopulmonary arrest, and began CPR and ACLS. The victim was initially in ventricular fibrillation and received two defibrillations, but the subsequent rhythm was asystole. He had transcutaneous pacing with initial capture and a weak pulse, but this could not be sustained, despite continued ACLS measures, including endotracheal intubation and administration of oxygen and multiple doses of medications. The victim never regained consciousness or effective cardiac electrical activity. The ambulance left the drill scene at 1930 hours and arrived at the hospital at 2031 hours. Assessment at the hospital showed fixed dilated pupils and asystole. Given this and the prolonged unsuccessful resuscitation efforts, the decision was made to stop the efforts, and the patient was pronounced dead. The death certificate, signed by the medical examiner, cited acute coronary insufficiency as the cause of death. No blood tests were done, and no autopsy was performed.

Discussions with family members and the personal physician indicate that although the victim had some risk factors for coronary artery disease, he reported no symptoms suggestive of heart disease. He had a routine physical examination (required as part of his commercial truck driving occupation) just a week before his death, and the results, including a chest radiograph and electrocardiogram, were within normal limits. The victim was taking no medications.

DESCRIPTION OF THE FIRE DEPARTMENT

At the time of the NIOSH investigation, the fire department was comprised of 30 fire fighters and served a population of 1,400 in two counties. The department made 100 runs in 1998, including 44

medical calls, 24 calls relating to fires, and 9 involving automobile crashes.

Training. The fire department provides all new fire fighters with the training required by the State of West Virginia, including basic Firefighter I training, First Aid and CPR, and Hazardous Material awareness training. In addition, the victim had at least eight other training courses over his 27 years as a volunteer fireman, covering such topic areas as advanced fire fighting, incident command, and infectious disease control.

Medical Clearance and Physical Fitness. The Department has no requirement for physical examinations and provides none. The department also does not have a medical clearance evaluation to wear a respirator, although in practice, older and physically impaired fire fighters do not perform activities requiring SCBA. No specific fire department programs were in place to enhance the cardiovascular/respiratory fitness of fire fighters.

DISCUSSION

Approximately 3 minutes after the victim's collapse, paramedics found the victim in ventricular fibrillation, an ineffective heart rhythm that, unless converted, is universally fatal. This arrhythmia is the most common type associated with cardiac arrest, occurring in 65-80% of all cardiac arrests.¹ In the United States, coronary artery disease (atherosclerosis) leading to a myocardial infarction (heart attack) is the most common risk factor for sudden cardiac death and cardiac arrest (80%), and is the presumed cause of the victim's sudden death in this investigation. This fatality occurred despite very prompt and appropriate ACLS efforts.

In the presence of atherosclerosis, cardiac stress due to mental or physical stress may be a factor in precipitating the chain of events leading to a heart



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attack. Firefighting activities are strenuous and often require fire fighters to work at near maximal heart rates for long periods. The increase in heart rate has been shown to begin with responding to the initial alarm and persist through the course of fire suppression activities.²⁻⁴ In this incident there was no actual fire, the victim was not engaged in strenuous fire fighting activities, nor did the victim appear to be under mental stress. However, it was a hot, humid day, and this, plus the heavy bunker gear, undoubtedly created some additional physical stress to the involved fire fighters.

Current NFPA 1582 guidelines⁵ for annual medical examination note that “no firm guidelines for stress electrocardiography in asymptomatic individuals have been developed.” However, they note that a reasonable approach would be to include treadmill testing for fire fighters at age 40, or 35 for those with a risk factor for coronary artery disease. This exercise stress testing procedure has errors both in over-diagnosis and in under-diagnosis, although newer techniques, including the use of Thallium administration or additional monitoring, can improve the accuracy of the procedure.⁶ It is thus possible that asymptomatic fire fighters could have coronary artery disease detected before an event such as a myocardial infarction occurred.

RECOMMENDATIONS AND DISCUSSION

The following recommendations address some general health and safety issues. It cannot be determined, however, whether these recommendations could have prevented the sudden cardiac arrest and subsequent death of this fire chief. This list includes some preventive measures that have been recommended by other agencies to reduce the risk of on-the-job heart attacks and sudden cardiac arrest among fire fighters. These recommendations have not been evaluated by NIOSH but represent research presented in the literature or consensus votes

of Technical Committees of the National Fire Protection Association or labor/management groups within the fire service. This strategy consists of (1) medical screening to identify and subsequently rehabilitate high-risk individuals; and (2) encouraging increased individual physical capacity. Steps that could be taken to accomplish these ends include the following:

Recommendation #1: Fire Fighters should have annual medical evaluations to determine their medical ability to perform duties without presenting a significant risk to the safety and health of themselves or others.

Guidance regarding the content and scheduling of periodic medical examinations for fire fighters can be found in *NFPA 1582: Standard on Medical Requirements for Fire Fighters*⁵ and in the report of the International Association of Fire Fighters/International Association of Fire Chiefs wellness/fitness initiative.⁸ In addition to providing guidance on the frequency and content of the medical evaluation, NFPA 1582 provides guidance on medical requirements for persons performing fire fighting tasks. Applying this recommendation involves legal and economic repercussions and may be particularly difficult for rural volunteer fire departments, such as the one involved in this incident, to implement. Such actions could negatively impact the ability to recruit and retain needed volunteers.

Recommendation #2: Provide fire fighters with medical evaluations to wear self-contained breathing apparatus (SCBA).

OSHA’s revised respiratory protection standard requires employers to provide medical evaluations and clearance for employees using respiratory protection.⁷ These clearance evaluations are required for private industry employees and public employees in States operating OSHA-approved



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State plans. Since West Virginia is not a State plan state, public employees are **NOT** required to comply with OSHA standards. Nonetheless, we recommend voluntary compliance with this aspect of the respiratory protection standard to help ensure that fire fighters can safely wear SCBA (and safely do fire fighting work, with or without an SCBA).

Recommendation #3: Perform an autopsy on all fire fighters who were fatally injured while on duty.

In 1995, the United States Fire Administration (USFA) published the *Firefighter Autopsy Protocol*.¹⁰ This publication hopes to provide “a more thorough documentation of the causes of firefighter deaths for three purposes:

1. to advance the analysis of the causes of fire fighter deaths to aid in the development of improved fire fighter health and safety equipment, procedures, and standards;
2. to help determine eligibility for death benefits under the federal government’s Public Safety Officer Benefits Program, as well as state and local programs; and
3. to address an increasing interest in the study of deaths that could be related to occupational illnesses among firefighters, both active and retired.”

Recommendation #4: Reduce risk factors for cardiovascular disease and improve cardiovascular capacity by implementing a wellness/fitness program for fire fighters.

NFPA 1500 requires a wellness program that provides health promotion activities for preventing health problems and enhancing overall well-being.⁹ In 1997, the International Association of Fire Fighters

and the International Association of Fire Chiefs joined in a comprehensive Fire Service Joint Labor Management Wellness/Fitness Initiative to improve fire fighter quality of life and maintain physical and mental capabilities of fire fighters. Ten fire departments across the United States joined this effort to pool information about their physical fitness programs and to create a practical fire service program. They produced a manual with a video detailing elements of such a program.⁸ Fire departments should review these materials to identify applicable elements for their department.

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INVESTIGATOR INFORMATION

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