



Fire Fighter Suffers a Heart Attack after Expressing Symptoms while on Duty - New Jersey

SUMMARY

On June 23, 2000, at about 1800 hours 37-year-old male Firefighter/EMT was eating dinner when he reported feeling ill. At approximately 2140 hours, the Firefighter had a witnessed cardiac arrest. Despite CPR and ALS administered by the ambulance paramedics and by hospital personnel in the emergency department, the Firefighter died. The death certificate, completed by the County Coroner, listed arteriosclerotic cardiovascular disease as the immediate cause of death. The autopsy, performed by the County Medical Examiner, showed mild coronary artery disease (CAD), softening or fibrosis of the myocardium, and evidence of old and recent myocardial infarctions.

Other agencies have proposed a three-pronged strategy for reducing the risk of on-duty heart attacks and cardiac arrests among fire fighters. This strategy consists of: 1) reducing physical stress on fire fighters; 2) screening to identify and subsequently rehabilitate high risk individuals; and 3) encouraging increased individual physical capacity. Issues relevant to this Fire Department include:

- *Provide mandatory annual medical evaluations to ALL fire fighters to determine their medical ability to perform duties without presenting a significant risk to the safety and health of themselves or others.*
- *Exercise stress tests should be incorporated into the Fire Department's medical evaluation program.*
- *Phase in a mandatory wellness/fitness program for fire fighters to reduce risk*

factors for cardiovascular disease and improve cardiovascular capacity.

INTRODUCTION & METHODS

On June 23, 2000, a 37-year-old male Firefighter/EMT died after suffering a heart attack while on duty as an EMT. On November 10, 2000, NIOSH contacted the affected Fire Department (FD) to initiate the investigation. On December 6, 2000, an Epidemiologist from the NIOSH Fire Fighter Fatality Investigation Team traveled to New Jersey to conduct an on-site investigation of the incident.

During the investigation NIOSH personnel interviewed either in person or by telephone:

- FD Chief
- The victim's wife
- Ambulance System Coordinator

During the site-visit NIOSH personnel reviewed:

- FD policies and operating guidelines
- FD training records
- FD annual report for 1999

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. The program does not seek to determine fault or place blame on fire departments or individual fire fighters. 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 www.cdc.gov/niosh/firehome.html or call toll free 1-800-35-NIOSH



Fatality Assessment and Control Evaluation Investigative Report #F2000-45

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- The victim's personnel file at the FD
- FD physical examination protocols
- Ambulance response report
- Hospital records
- Death Certificate
- Autopsy report

INVESTIGATIVE RESULTS

Incident. On June 23, 2000, the victim reported for work at 0800 hours. The victim did not respond to any emergency incidents during the day. At 1800 hours his shift ended at the Fire Department, but then he reported to work with the county ambulance service. At approximately 2040 hours, the victim and his ambulance crew went to a local restaurant for dinner. While he was eating he complained of indigestion and being unusually warm. He attributed this to an apparent illness he had for a few days. At 2141 hours, the victim began having seizure activity while watching television at the ambulance station. His ambulance crew immediately called for an ambulance and began CPR. The ambulance arrived on the scene at 2145 hours.

Initial assessment found the victim to be unresponsive and without pulse or respirations. A heart monitor indicated the victim was in ventricular fibrillation (a heart rhythm incompatible with life). The ambulance crew immediately began ALS protocol. The victim was defibrillated three times without converting the victim's heart to a life sustaining rhythm prior to departing for the hospital. An IV was established and drugs were administered en route to the hospital. The victim arrived at the hospital's emergency department at 2215 hours. The victim was pronounced dead in the emergency room at 2217 hours.

Medical Findings. The death certificate, completed by the County Medical Examiner, listed arteriosclerotic cardiovascular disease as the

immediate cause of death. Pertinent findings from the autopsy, performed by the Deputy Chief Medical Examiner, were:

- Three arteries are calcified with 10% to 50% obstruction multi focally
- Nonadherent thrombus in the right coronary artery
- Mild atherosclerosis of the mitral and aortic valves
- A 1 cm scar in the posterior wall of the left ventricle, inferiorly

Medical history indicated that the victim had six coronary artery disease (CAD) risk factors: family history, hypertension, hyper-cholesterolemia, male gender, obesity and smoking. The FD contracted with a local occupational health company to complete a medical examination on all fire fighters every other year. The victim's last examination was completed in 1999. Prior to his MI, the victim did not relate any symptoms suggestive of ischemic heart pain (angina) to his wife, friends, or co-workers though he thought that he was suffering from a cold for several days.

DESCRIPTION OF THE FIRE DEPARTMENT

At the time of the NIOSH investigation, the Fire Department consisted of 15 uniformed career personnel and approximately 131 volunteer personnel. This Department serves a population of 25,000 residents in a geographic area of 17.4 square miles. There are eight fire stations. Fire fighters, including the victim, work on one of three shifts from 0800-0800 hours, 24-hours on-duty, 48-hours off-duty.

In 1999, the Department responded to 13,664 calls: 366 fires, 461 emergency medical treatment calls/ other rescue calls, 259 hazardous condition calls, 1 over pressure/rupture call, 166 service calls, 307 good intent calls, 307 other false calls.



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Training. The Fire Department requires all new fire fighters to pass a preplacement physical examination, a timed physical agility test, and a written civil service test. Once hired, the fire fighter must complete training at the county fire academy. Once the recruit phase is completed, the Fire Fighter is assigned to a shift. Subsequent training is conducted on-shift. There is a no minimum state requirement for fire fighter certification or for annual fire fighter recertification. The victim was certified as a Fire Fighter II, Driver/Operator, Hazmat, and Fire Investigator, Fire Inspector, EMT, and had 13 years of fire fighting experience.

Pre-placement Evaluations. The Department requires a pre-placement medical evaluation for all new hires, regardless of age. Components of this evaluation for all applicants (career) include the following:

- Physical examination
- Blood tests: Complete Blood Count (CBC), Metabolic profile, Lipid profile, Pregnancy test for female applicants, Hepatitis B and C screen, Syphilis test
- Chest x-ray
- Pulmonary function tests (PFT)
- Dip stick urinalysis
- Drug Screen: urine and hair
- Audiogram
- Vision test: distant and near vision

These evaluations are performed by a contractor who makes a determination regarding medical clearance for fire fighting duties and forwards this decision to the FD.

Periodic Evaluations.

Periodic evaluations are required for all career fire fighters every other year. The content of the medical evaluation is the same as the preplacement.

If an employee is injured at work or is ill, the private physician evaluates the employee and provides

clearance for returning to work. Although all fire stations have exercise (strength and aerobic) equipment, primarily purchased by the fire fighters, the Department does not have a mandatory fitness program. No wellness programs (smoking cessation, weight control, high blood pressure, diabetes, or cholesterol) are offered by the FD or the City.

DISCUSSION

In the United States, coronary artery disease (atherosclerosis) is the most common risk factor for cardiac arrest and sudden cardiac death.¹ Risk factors for its development include increasing age, male gender, family history of coronary artery disease, smoking, high blood pressure, high blood cholesterol, obesity/physical inactivity, and diabetes.² The victim had six of these risk factors (family history, hypertension, hyper-cholesterolemia, male gender, obesity and smoking).

The narrowing of the coronary arteries by atherosclerotic plaques occurs over many years, typically decades.³ However, the growth of these plaques probably occurs in a nonlinear, often abrupt fashion.⁴ Heart attacks typically occur with the sudden development of complete blockage (occlusion) in one or more coronary arteries that have not developed a collateral blood supply.⁵ This sudden blockage is primarily due to blood clots (thrombosis) forming on the top of atherosclerotic plaques. A fresh thrombus found in the victim's RCA during the autopsy was consistent with an acute MI. In addition, his 1 cm scar in the inferior/posterior portion of the left ventricle is consistent with a remote (at least three months prior) heart attack. Given the small size of this infarct and its location, it is not surprising that the victim did not report prior symptoms of chest pain, or that his EKG was normal.

The Department requires a preplacement medical examination for all new hires and requires periodic



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medical evaluations for all fire fighters. NFPA recommends a yearly physical evaluation to include a medical history, height, weight, blood pressure, and visual acuity test.⁸ NFPA also recommends a thorough examination to include vision testing, audiometry, pulmonary function testing, a complete blood count, urinalysis, and biochemical (blood) test battery be conducted on a periodic basis according to the age of the fire fighter (less than 30: every 3 years; 30-39: every 2 years; over 40 years: every year). Only preplacement chest X-rays are recommended therefore would not be necessary during the periodic examination.

To reduce the risk of heart attacks and sudden cardiac arrest among fire fighters, the National Fire Protection Association (NFPA) has developed guidelines entitled “Standard on Medical Requirements for Fire Fighters and Information for Fire Department Physicians,” otherwise known as NFPA 1582.⁸ They recommend, in addition to screening for risk factors for CAD, an exercise stress EKG, otherwise known as an exercise stress test (EST) which is used to screen for CAD. The NFPA recommends an EST for individuals with risk factors for CAD starting at age 35. Unfortunately, it has problems with both false negatives (inadequate sensitivity) and false positives (inadequate specificity), particularly for asymptomatic individuals (individuals without symptoms suggestive of angina), young men, and women.^{9,10} This has led other expert groups to **not** recommend EST for asymptomatic individuals without risk factors for CAD.^{11,12}

When these asymptomatic individuals **have** risk factors for CAD, however, recommendations vary by organization. The American College of Cardiology/American Heart Association (ACC/AHA) identifies four groups for EST although they note that the “usefulness/efficacy is less well established by evidence/opinion.”¹¹

- Group 1: Persons with multiple risk factors. They define five risk factors for CAD: hypercholesterolemia (total cholesterol greater than 240 mg/dL), hypertension (systolic greater than 140 mm Hg or diastolic greater than 90 mm Hg), smoking, diabetes, and family history of premature CAD (cardiac event in 1st degree relative less than 60 years old). This fire fighter fits into this group.
- Group 2: men over the age of 40 and women over the age of 50 (especially if sedentary) who plan to start vigorous exercise.
- Group 3: men over the age of 40 and women over the age of 50 who are at high risk for CAD due to other diseases (e.g. chronic renal failure).
- Group 4: men over the age of 40 and women over the age of 50 who are involved in occupations in which impairment might impact public safety.

The U.S. Preventive Services Task Force (USPSTF) does not recommend EST for asymptomatic individuals, even those with risk factors for CAD; rather, they recommend the diagnosis and treatment of modifiable risk factors (hypertension, high cholesterol, smoking, and diabetes).¹² The USPSTF indicates that there is insufficient evidence to recommend screening middle age and older men or women in the general population, however, “screening individuals in certain occupations (pilots, truck drivers, etc) can be recommended on other grounds, including the possible benefits to public safety.”¹²

This victim had multiple risk factors for CAD. NFPA 1582 recommends ESTs for Fire Fighters with multiple risk factors for CAD starting at age 35. An EST might have identified his CAD, thereby leading to further evaluation and treatment, and possibly the prevention of his sudden cardiac death.



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RECOMMENDATION AND DISCUSSION

The following recommendations address health and safety generally. This list includes some preventive measures that have been recommended by other agencies to reduce the risk of on-the-job cardiac arrest among fire fighters. These recommendations have not been evaluated by NIOSH, but represent published research or of consensus votes of Technical Committees of the National Fire Protection Association or labor/management groups within the fire service. In addition, they are presented in a logical programmatic order, and are not listed in a priority manner.

Recommendation #1: Provide mandatory annual medical evaluations to ALL fire fighters to determine their medical ability to perform duties without presenting a significant risk to the safety and health of themselves or others.

The content and frequency of this evaluation should be negotiated between the Fire Department and the local union. Guidance regarding the content and frequency of periodic medical evaluations can be found in NFPA 1582, Standard on Medical Requirements for Fire Fighters and Information for Fire Department Physicians,⁸ and in the report of the International Association of Fire Fighters/International Association of Fire Chiefs (IAFF/IAFC) wellness/fitness initiative.¹³ The department is not legally required to follow any of these standards. Nonetheless, we recommend the City and Union negotiate the content and frequency to be consistent with the above guidelines.

Specifically, according to NFPA 1582, “the use of chest x-rays in surveillance activities in the absence of significant exposures, symptoms, or medical findings has not been shown to reduce respiratory or other health impairment. Therefore, only replacement chest X-rays are recommended.” The extra chest X-rays being conducted by the Fire Department expose incumbents to unnecessary

radiation and represent an unnecessary expense for the Fire Department.

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. NFPA 1582 should be applied in a confidential, nondiscriminatory manner. Appendix D of NFPA 1582 provides guidance for Fire Department Administrators regarding legal considerations in applying the standard.

Applying NFPA 1582 also involves economic issues. These economic concerns go beyond the costs of administering the medical program; they involve the personal and economic costs of dealing with the medical evaluation results. NFPA 1500, Standard on Fire Department Occupational Safety and Health Program, addressed these issues in Chapter 8-7.1 and 8-7.2.¹⁴

The success of medical programs hinges on protecting the affected fire fighter. The Department must (1) keep the medical records confidential, (2) provide alternated duty positions for fire fighters in rehabilitation programs, and (3) if the fire fighter is not medically qualified to return to active fire fighting duties, provide permanent alternate duty positions or other supportive and/or compensated alternatives.

Recommendation #2: Exercise stress tests should be incorporated into the Fire Department’s medical evaluation program.

NFPA 1582, Standard on Medical Requirements for Fire Fighters and Information for Fire Department Physicians, and the International Association of Fire Fighters/International Association of Fire Chiefs (IAFF/IAFC) wellness/fitness initiative both recommend at least biannual EST for fire fighters.^{8,13} They recommend that these tests begin at age 35 for

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those with CAD risk factors, and at age 40 for those without CAD risk factors. The EST could be conducted by the fire fighter's personal physician (at City or Fire Department expense) or the City physician. If the fire fighter's personal physician conducts the test, the results must be communicated to the City physician, who is responsible for decisions regarding medical clearance for fire fighting duties.

Recommendation #3: Phase in a mandatory wellness/fitness program for fire fighters to reduce risk factors for cardiovascular disease and improve cardiovascular capacity.

Physical inactivity, or lack of exercise, is the most prevalent modifiable risk factor for CAD in the United States. Additionally, physical inactivity is associated with other risk factors, namely obesity and diabetes.¹⁷ NFPA 1500, Standard on Fire Department Occupational Safety and Health Program, requires a wellness program that provides health promotion activities for preventing health problems and enhancing overall well-being.¹⁴ In 1997, the International Association of Fire Fighters (IAFF) and the International Association of Fire Chiefs (IAFC) 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 and a video detailing elements of such a program.¹³ The Fire Department and the Union should review these materials to identify applicable elements for their Department. Other large city negotiated programs can also be reviewed as potential models. Wellness programs have been shown to be cost effective, typically by reducing the number of work-related injuries and lost work days.^{15,16}

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INVESTIGATOR INFORMATION

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