



Arson Investigator Dies from Injuries Sustained from a Fall During an Arson Investigation—Illinois

SUMMARY

On July, 18, 2000, at 1351 hours, Central Dispatch notified the local fire department of a structure fire at a single-family dwelling. As fire fighters conducted suppression activities near the rear of the structure, they became suspicious of arson. Two arson investigators were dispatched to the scene to conduct an “origin-and-cause” fire investigation. During this investigation, Arson Investigator #1, a 47-year-old, career fire fighter (the victim) lost his balance and fell, pinning his camera between the left side of his chest and a bed frame/slats. After being assisted to his feet by Arson Investigator #2, he rested for a couple of minutes, regained his composure, and resumed his investigation. Later that evening the victim sought medical attention for persistent, severe pain in his left lower chest area. Over the next 3 weeks, the victim was evaluated and treated both in and out of the hospital for complications resulting from the fall. These complications ultimately led to his death on August 9, 2000, at 1118 hours. Two autopsies were performed. The first autopsy, performed by the County Coroner, showed (a) “multiple organ system failure” due to, or as a consequence of, (b) “peritonitis with severe hypotension, ischemic necrosis of the liver and kidneys” due to, or as a consequence of, (c) “blunt force trauma of the left chest wall with splenic hematomas and a perforated stress ulcer.” The second autopsy, performed by a forensic pathologist hired by the victim’s widow, essentially confirmed these findings with two additional points mentioned. A left-arm contusion (bruise), a left-trunk contusion, and a left-10th-rib fracture were noted, suggesting the initial fall on July 18 was quite severe. A second point in this autopsy was that post-injury medications, in

addition to chronic hepatitis C virus (HCV) infection and cirrhosis due to HCV, contributed to his liver failure. NIOSH investigators concluded that, to minimize the risk of similar occurrences the following recommendations should be considered:

- ***Fire departments should ensure that fire fighters and EMTs have mandatory annual medical evaluations and periodic physical examinations according to the National Fire Protection Association (NFPA) 1582, Standard on Medical Requirements for Fire Fighters and Information for Fire Department Physicians.***
- ***HCV infection, by itself, should not preclude or restrict fire-service employees from engaging in fire-service activities. Rather, fire-department physicians should determine if HCV liver disease is of sufficient severity to prevent employees from performing, with or without reasonable accommodation, the essential functions of the job without posing a***

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

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significant risk to the safety and health of themselves or others.

- ***Fire departments should update their written “Communicable Disease Program” to assure consistency with the NFPA 1581: Standard of Fire Department Infection Control Program and the OSHA Bloodborne Pathogens Standard [29 CFR 1910.1030; 56 Fed. Reg. 64004 (1991)].***

INTRODUCTION

On July 18, 2000, fire fighters from the involved career fire department responded to a structure fire at a single-family dwelling. During suppression activities, fire fighters suspected arson and requested that an arson investigator be sent to the scene. Two arson investigators conducted a post-fire origin-and-cause investigation. While conducting the investigation, one of the arson investigators fell, sustaining an injury. Three weeks later he died due to a series of complications from this injury.

On August 11, 2000, the United States Fire Administration (USFA) notified the National Institute for Occupational Safety and Health (NIOSH) of this incident. On September 25-26, 2000, two safety and occupational health specialists from the Division of Safety Research (DSR) initiated the NIOSH investigation. On October 19, 2000, a safety and occupational health specialist and an occupational physician from the Division of Surveillance, Hazard Evaluations, and Field Studies (DSHEFS) traveled to Illinois to continue the NIOSH investigation.

Interviews were conducted with the Fire Chief, the International Association of Fire Fighters (IAFF) local president, the State Fire Marshal, members of the Arson Unit, members of the fire department, and the attorney representing the

victim’s spouse. Copies of witness statements, training records, standard operating procedures (SOPs), pathology reports, and drawings of the fire scene were reviewed, and a visit to the fire scene was conducted.

INVESTIGATION

On July, 18, 2000, at 1351 hours, Central Dispatch notified the involved fire department of a structure fire at a single-family dwelling. At 1353 hours, the following units arrived on the scene: Battalion 2; Engines 1, 4, 5, and 6; and Truck 1. A total of 17 fire-department personnel responded to the initial alarm. Battalion 2, the first unit to arrive on the scene, reported smoke showing from the eaves of the structure and fire showing from the rear of the structure. Engine 5 connected to a hydrant at an intersection near the fireground. Engine 6 connected to a hydrant at an intersection opposite that of Engine 5. A total of four hoselines were pulled in this incident. Engine 5 and Engine 6 each had two, 1½-inch lines pulled off for fire suppression. Three of these lines were used for extinguishment and the fourth was used to protect the exposure, located approximately 3 feet from the fire structure. As fire fighters conducted suppression activities near the rear of the structure they became suspicious that the fire could have been intentionally started on the outside of the structure, and declared the fire a “Code M fire.” “Code M” is declared when a fire is believed to be suspicious in nature and the arson unit is requested to conduct an “origin-and-cause” investigation.

According to departmental procedures, two arson investigators were dispatched to the scene at 1420 hours to conduct the investigation. Arson Investigator #1, a 47-year-old, career fire fighter (the victim) arrived on the scene at 1435 hours while Arson Investigator #2 arrived on the scene at approximately 1500 hours. While performing



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the investigation, the victim stepped into a refrigerator (which was lying faceup on the ground with the door open) to get a closer look and photograph a utility service drop. After attaining the information and the photograph he needed, he began to step out of the refrigerator, and his boot caught the lip of the refrigerator. He lost his balance, fell, and landed on top of a section of a bed frame which contained slats. He landed on the left side of his chest atop the bed slats with his camera (Pentax K-1000 with 50-mm lens) pinned between his lower chest and the bed slats. After being assisted back to his feet by Arson Investigator #2, he rested for a couple of minutes, regained his composure, and resumed his investigation. At approximately 1615 hours, the victim and Arson Investigator #2 concluded their investigation and left the fire scene.

After leaving the fire scene, the victim went home. A short time after arriving home, he related to his wife that he did not feel well and went to an urgent-care facility. After receiving treatment, he went back home. The next day, July 19, the victim went to work as usual, but his supervisor, the Fire Marshal, noticed that he did not look well and advised him to seek further medical treatment and to rest at home. The victim went home, and later that evening he was taken by ambulance to the hospital. Over the next 3 weeks, the victim was evaluated and treated both in and out of the hospital for complications resulting from the fall. He died on August 9, 2000, at 1118 hours. Details of the events leading up to his death were not available to NIOSH investigators, nor were any of the victim's medical records.

A summary of the County Coroner's autopsy was provided to NIOSH investigators by the widow's attorney. This summary listed the immediate cause of death as (a) "multiple organ system failure" due to, or as a consequence of, (b) "peritonitis

with severe hypotension, ischemic necrosis of the liver and kidneys" due to, or as a consequence of, (c) "blunt force trauma of the left chest wall with splenic hematomas and a perforated stress ulcer." The report stated: "Blunt force trauma of the left chest wall resulted in a massive intrasplenic hematoma and the development of a stress ulcer. The spleen was not ruptured. The stress ulcer perforated, releasing bowel contents into the peritoneal cavity, which resulted in fibrinous peritonitis. Hypotensive episodes secondary to the peritonitis led to multiple organ system failure, specifically generalized ischemic necrosis of the liver (superimposed upon hepatitis C induced micronodular cirrhosis), acute tubular necrosis of the kidneys and infarction of the rectosigmoid colon. The combination of liver failure and renal failure constitutes so-called 'multiple organ system failure' and was the immediate cause of death. The underlying cause of death was blunt force trauma of the left chest wall."

Two days later, a second autopsy was performed by a forensic pathologist hired by the victim's widow. This autopsy essentially confirmed the findings of the first autopsy with two additional points mentioned. A left-arm contusion (bruise), a left-trunk contusion, and a left-10th-rib fracture were noted, suggesting the initial fall on July 18 was quite severe. A second point in this autopsy was that post-injury medications, in addition to chronic hepatitis C virus (HCV) infection and cirrhosis due to HCV, contributed to his liver failure.

DESCRIPTION OF THE FIRE DEPARTMENT

This career fire department consists of 215 uniformed personnel and a Chief. The department serves a population of 140,000 in an area of 120 square miles. The state of Illinois requires all fire fighters to be certified at the Fire Fighter I and II



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levels. Regularly scheduled training is conducted and documented by in-house-certified trainers. The department requires all arson investigators to complete the following training: Fire Fighter II, and Fire-Arson Investigator I, II, and III. The victim had 1½ years of experience as an arson investigator for this department.

Training. The victim completed the following training: Journeyman Fire Fighter; Fire Fighter I and II; Fire-Arson Investigator I, II, and III; Hazardous Materials First Responder; Hazardous Materials Awareness; Hazardous Material Emergencies (reactive, explosive and unknown); Emergency Response; Emergency Medical Technician (EMT) - A; and Armed Services Vocational Aptitude Battery. He had 15 years of fire-fighting experience, all served with this department.

Preemployment/Preplacement Evaluations. The fire department requires a preemployment/preplacement medical evaluation for all fire-fighter candidates. Components of the preemployment/preplacement evaluation include the following:

- Physical examination
- Vision test
- Neurological examination

These evaluations are performed by a contractor hired by the City, who then makes a decision regarding medical clearance for fire-fighting duties. This decision is forwarded to the City Personnel Director.

Periodic Evaluations. Periodic medical evaluations are not required by this department. Although all fire stations have exercise (strength and aerobic) equipment, primarily purchased by the fire department, the Department does not have a mandatory fitness program.

DISCUSSION

In 2000, the NFPA updated Standard 1582, Standard on Medical Requirements for Fire Fighters and Information for Fire Department Physicians.¹ This voluntary industry standard specifies minimum medical requirements for incumbent and candidate fire fighters, and provides guidance to fire-department physicians on the content and frequency of fire-fighter medical evaluations. NFPA 1582 recommends that candidates and incumbents be evaluated for gastrointestinal (GI) disorders and suggests that liver-function tests be performed. If GI disorders are diagnosed, they are considered “Category B Medical Conditions” which are “medical conditions that, based on it’s severity or degree, **could** (our emphasis) preclude a person from performing as a fire fighter in a training or emergency operational environment by presenting a significant risk to the safety and health of the person or others.”¹

HCV infection can cause **acute hepatitis** and, over time, frequently causes **chronic active hepatitis** and/or **cirrhosis** (discussed below), all Category B diagnoses. Thus, HCV infection, by itself, should not preclude or restrict fire fighters from engaging in fire-fighter activities. Rather, fire-department physicians should determine if the liver disease is of sufficient severity to prevent fire fighters from performing, with or without reasonable accommodation, the essential functions of the job without posing a significant risk to the safety and health of themselves or others.

During our investigation many members of this fire department expressed concern over the issue of hepatitis C virus (HCV) infection in fire fighters and its contribution to the death of this victim. Given our lack of access to medical records, this report will not address how this individual became

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infected with hepatitis C nor will it address whether it contributed to his death. Rather, the rest of this discussion section will address the overall issue of HCV, HCV infection in fire fighters and other first responders, and recommendations for fire departments to prevent its occupational transmission.

Hepatitis is a term describing inflammation of the liver. There are many known causes of hepatitis, including chemical and infectious agents. HCV is a virus that causes an infection responsible for a large part of what was previously referred to as non-A, non-B hepatitis. HCV infection is the most common chronic bloodborne infection in the United States, and approximately 85% of HCV-infected persons develop chronic HCV infection.² HCV infection is usually asymptomatic; it is often detected at the time of a routine physical examination (if routine liver-function tests are abnormal) or blood donation (donated blood is screened for HCV). The symptoms of chronic HCV infection, which may include fatigue, aching joints, abdominal discomfort, or other symptoms associated with complications of chronic liver disease, may not appear for many years after infection.

HCV infection is diagnosed by testing the blood for antibodies to HCV (anti-HCV). Overall, 1.8% of the general population, an estimated 3.9 million people, are infected with HCV.³ This prevalence of HCV infection varies among sub populations according to the presence of various risk factors for infection. Risk factors for the transmission of HCV include transfusion or transplant from an infected donor, intravenous drug use, hemodialysis, needlestick injuries, sexual or household exposure to infected persons, multiple sex partners, and perinatal exposure to an infected mother.^{4,5} HCV is now rarely transmitted by blood

transfusion in the U.S. because of screening tests which exclude infectious donors.⁶ Approximately 10% of persons with HCV infection have no recognized source of infection.²

Individuals at high risk for HCV infection include persons who ever injected illegal drugs, persons with certain medical conditions (such as long-term hemodialysis patients), and persons who have had transfusions or organ transplant prior to July 1992 or who received blood from a donor who tested positive for HCV infection. The Centers for Disease Control and Prevention (CDC) currently recommends routine HCV testing (to detect anti-HCV) for persons, including fire fighters, first responders, and emergency medical personnel, who have a history of these risk factors or for follow-up of a specific exposure.²

First responders and others who are exposed to blood in the workplace are at risk for infection with bloodborne pathogens such as HCV. Specific exposures of concern to first responders would include percutaneous (needle stick) and permucosal (blood splashed on the surfaces of mucous membranes) exposures to HCV-positive blood. Given that first responders (fire fighters/EMTs) are estimated to have 104 needlestick injuries (NSI) per 1,000 person-years,⁷ that the HCV seroprevalence of the NSI source ranges from 1.8% to 18.2%,^{8,9} and that the HCV seroconversion with an NSI is estimated to be 1.8%,¹⁰ we would expect between 3 and 34 first responders/100,000 to have occupationally acquired HCV infection per year. While this may represent a “low risk,” it is important to those individuals and their families who acquired this occupational disease. The poor reporting of NSI among first responders is probably responsible for the lack of a documented case of post-exposure HCV seroconversion.



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A recent article reported the results of five cross-sectional studies of hepatitis C virus (HCV) among fire fighters, emergency medical technicians, and paramedics.¹¹ These surveys reported the prevalence of HCV infection among first responders to range between 1.3-3.2%, with the age- and sex-adjusted prevalences similar to those of the general population. However, first responders should arguably have a lower prevalence were it not for occupational HCV infection. As job applicants, they are typically screened for illicit drug use and a variety of medical conditions, including liver disease.^{1,12} Applicants with positive drug tests or advanced liver disease are excluded from entering the first responder workforce. Since illicit/injection drug use is the major cause of HCV,^{2-5,13,14} first responders would be expected to have a lower HCV seroprevalence than the general population. In addition, due to the heavy physical demands placed upon first responders,¹⁵ those with advanced liver disease (cirrhosis or chronic active hepatitis) may exit the workforce.¹ These two factors represent the “healthy worker effect,” a well-recognized selection bias encountered in occupational epidemiology that can mask occupational disease.¹⁶ Thus, it is entirely possible that first responders are at lower risk of non-occupational HCV infection, but their additional occupational risk results in an overall HCV prevalence similar to the general population.

RECOMMENDATIONS AND DISCUSSION

This Arson Investigator died from a series of complications following an injury sustained during an arson investigation. The following recommendations address some general health and safety issues for fire departments to consider when developing or updating safety and health policies and procedures.

Recommendations #1: Fire departments should ensure that fire fighters and EMTs have mandatory annual medical evaluations and periodic physical examinations according to the National Fire Protection Association (NFPA) 1582, Standard on Medical Requirements for Fire Fighters and Information for Fire Department Physicians.

Although the fire department is not legally required to follow NFPA 1582, NIOSH recommends the content and frequency of the medical evaluations to be consistent with these guidelines. Applying NFPA 1582 involves legal issues, so it should be carried out 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, addresses these issues in Chapter 8-7.1 and 8-7.2.¹⁷ The success of medical programs hinges on protecting the affected fire fighter. The fire department must (1) keep the medical records confidential, (2) provide alternate-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: HCV infection, by itself, should not preclude or restrict fire-service employees from engaging in fire-service activities. Rather, fire-department physicians



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should determine if the HCV liver disease is of sufficient severity to prevent employees from performing, with or without reasonable accommodation, the essential functions of the job without posing a significant risk to the safety and health of themselves or others.

In the absence of other risk factors for infection with HCV, routine screening for anti-HCV is not recommended for health care, emergency medical, or public safety workers (including fire fighters and first responders).² Rather, testing of fire fighters and emergency medical personnel (as well as hospital-based health care workers) is recommended only for follow-up of specific exposures (percutaneous and permucosal exposure to blood of unknown HCV status), or, as described earlier, when there are other (non-occupational) risk factors.^{2,11}

Documentation of an occupational exposure as a source of HCV infection in workers such as fire fighters and emergency medical personnel is best accomplished by following current recommendations for post-exposure follow-up and testing. These current recommendations include an anti-HCV test performed soon after an exposure incident—this will determine the worker’s “baseline” HCV status prior to the exposure incident.^{2,18} In most cases, preemployment anti-HCV testing will not provide an adequate preexposure “baseline” for workers occupationally exposed to potentially infectious material since it would not account for infection acquired (occupational or nonoccupational) during the period between the preemployment test and the exposure incident.

Recommendation #3: Fire departments should update their written “Communicable Disease Program” to assure consistency with NFPA 1581: Standard on Fire Department Infection

Control Program, and the OSHA Bloodborne Pathogens Standard [29 CFR 1910.1030; 56 Fed. Reg. 64004 (1991)].

HCV is transmitted primarily by large or repeated percutaneous exposures to HCV-positive blood. Because fire fighters and other emergency medical personnel are at risk for occupational exposure to bloodborne pathogens, including HCV, implementation of an appropriate bloodborne-pathogen program for these workers is essential. Education concerning prevention of such bloodborne exposures, training concerning proper safety measures, use of appropriate personal protective equipment, as well as appropriate follow-up should an exposure occur, are important parts of any bloodborne-pathogen program. The infection control officer should be responsible for putting together and implementing the control plan for bloodborne pathogens. Appendix A contains a summary of recommendations for a bloodborne-pathogens program for an emergency medical service. We have also provided the fire department with copies of these three documents:

NFPA 1581: Standard on Fire Department Infection Control Program

OSHA: Bloodborne Pathogens Standard [29 CFR 1910.1030; 56 Fed. Reg. 64004 (1991)]

CDC: Recommendations for Prevention and Control of Hepatitis C Virus (HCV) Infection and HCV-related Chronic Disease

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