

STATE FIRE MARSHAL'S OFFICE

Line of Duty Death Investigation



Investigation Number 03-221-02

Fire-Rescue Recruit Wayne Kevin Clarke

Dallas Fire-Rescue

February 12, 2003

Texas Department of Insurance
Austin, Texas

TABLE OF CONTENTS

Summary	3
---------	---

The Investigation

Introduction	3
Origin and Cause Investigation	4
Building Structure and Systems	4
Death Investigation	4
Personal Protective Equipment Evaluation	6
Medical Background of Firefighter	6

Findings/Recommendations

Findings	6
Recommendations	7
Cause of Death General Information	8

Summary

A firefighter recruit, age 46, collapsed and died of a heart condition while participating in physical training in a basic firefighter academy class on February 12, 2003.

Wayne Clarke, a firefighter recruit of Dallas Fire-Rescue, was on his third trip up the stairs of a six-story fire training tower when he complained of pain in his leg and neck and was not able to continue. An instructor and three other recruits carried Clarke down the stairs of the tower.

When they reached ground level with Clarke, he was conscious but unresponsive to verbal stimuli and his skin appeared ashen. His condition deteriorated rapidly as he became unresponsive, stopped breathing and went into cardiac arrest. Instructors and recruits performed CPR and Clarke was taken to a local hospital.

Clarke failed to respond to resuscitation efforts and was pronounced dead at 9:07 AM. The autopsy report stated the cause of death was due to cardiac hypertrophy.

Fire-Recruit Wayne Kevin Clarke had been employed by Dallas Fire-Rescue for nearly three months. He is survived by his wife and two children.

Introduction

The Texas State Fire Marshal's Office was notified of the death of Dallas Fire-Rescue Recruit firefighter Wayne Clarke on February 12, 2003. State Fire Marshal's Office (SFMO) Investigator Ed Cheever was assigned as the lead investigator. Cheever traveled to the Dallas Fire-Rescue Training Academy on February 12, 2003 to conduct an investigation of the incident.

The SFMO commenced an LODD investigation under the authority of Texas Government Code Section 417.0075. The statute requires SFMO to investigate the circumstances surrounding the death of the firefighter, including the cause and origin of the fire, the condition of the structure, and the suppression operation, to determine the factors that may have contributed to the death of the firefighter. The State Fire Marshal is required to coordinate the investigative efforts of local government officials and may enlist established fire service organizations and private entities to assist in the investigation.

The National Fallen Firefighter's Foundation and the National Institute for Occupational Safety and Health (NIOSH) Fire Fighter Fatality Investigation and Prevention Program were notified.

Origin and Cause Investigation

This fatality did not occur as a result of firefighting operations. It occurred during a firefighter recruit training class.

Building Structure and Systems

The Dallas Fire-Rescue training tower is a six-story structure with interior stairs and equipment used for recruit and in-service training.

Investigation of the Death of the Firefighter

At approximately 8:30 AM on February 12, 2003, Wayne Clarke, a firefighter recruit of Dallas Fire-Rescue was on his third trip up the stairs of a six-story fire training tower when he stopped and dropped the hose bag he was carrying on the fourth floor landing and was observed continuing up the stairs using a Halligan tool like a cane. Clarke reached the top floor and fell to his knees. At this point, Clarke's low air alarm began to sound on his SCBA. He then started down the stairs in a seated position toward the fifth floor when the lead instructor inquired as to what was wrong. Clarke stopped and stated to the lead instructor that he had pain in his leg. Two recruits heard Clarke then indicate that he also had pain in his neck. The instructor told him to stop and not to attempt to complete the drill. Clarke removed his SCBA regulator from his facemask. The instructor and other fire recruits removed Clarke's helmet and protective hood when Clarke told the instructor he could not continue. Two recruits put Clarke's arms over their shoulders to assist him down the stairs. Clarke was using his legs but the instructor observed he was very weak. The instructor took one of Clarke's legs and a third recruit took his other leg and the four of them carried Clarke to ground level and placed him in a sitting position against an outside wall of the tower.

At that time Clarke was conscious but unresponsive to verbal stimuli and his skin appeared ashen. The instructor and the recruits placed Clarke in a supine position and began removing his remaining protective equipment. Clarke had a strong carotid pulse and a weak radial pulse when palpated. The lead instructor sent one recruit after another instructor and another recruit to bring some water to Clarke. Dallas 911 was called at 8:32 AM to request an ALS Rescue unit.

The lead instructor continued to speak to Clarke but he was unresponsive. Two other instructors arrived and an oxygen resuscitator was obtained from one of the training academy fire engines. Oxygen was administered via a non-rebreathing mask as they continued assessing Clarke's condition. Clarke's radial pulse was not perceptible although a carotid pulse was still detected. The instructors then observed that Clarke stopped breathing and mouth-to-mouth resuscitation was initiated. Shortly afterward, a bag-valve-mask was utilized for the ongoing resuscitation effort.

A recruit assisting with Clarke's treatment could no longer find a carotid pulse and cardiopulmonary resuscitation was initiated. An automatic external defibrillator (AED) was obtained from the training academy but was not used because its battery was low. A Dallas Fire-Rescue ALS Rescue unit and Engine company arrived at 8:36 AM.

Paramedics took a rapid electrocardiogram that indicated Clarke was in ventricular fibrillation. An intravenous line was started and an endotracheal tube inserted. Paramedics defibrillated Clarke three times and his fibrillating heart rhythm changed to asystole. Clarke was placed in the Rescue unit at 8:42 AM and CPR and ALS treatment continued as Clarke was transported to Baylor University Medical Center, arriving at 8:51 AM.

Clarke failed to respond to resuscitation efforts at the hospital and he was pronounced dead at 9:07 AM.

Recruit Academy Physical Conditioning

The Dallas Fire-Rescue Recruit Academy curriculum meets the requirements of the Texas Commission on Fire Protection (TCFP). Physical training is not required by the TCFP basic firefighter curriculum, but Dallas, as well as many other training providers, includes physical conditioning in their recruit academies. Dallas Fire-Rescue does not have a written lesson plan for physical training. Exercise programs and physical conditioning and performance drills are instead passed down from recruit class to recruit class. Dallas Fire-Rescue has a physical fitness coordinator but the coordinator works with in-service personnel and is not involved in planning recruit academy classes. Instructors for recruit academies are selected from line firefighters and officers.

Physical conditioning precedes the training tower climb. The training tower climb is intended to develop strength and endurance. Recruits initially begin climbing the training tower in athletic clothing and shoes and progress during their time at the academy to wearing protective clothing only, then adding SCBA, and finally wearing full protective clothing, breathing from an SCBA, carrying firefighting equipment and making multiple trips up and down the tower stairs. There are no set performance objectives for climbing the stairs. A benchmark time is set during each academy class based on an average of times of recruits in that class.

Recruits went through several warm-up exercises prior to beginning the tower climb on the date of the incident. The temperature at Dallas Love Field at 7:53 AM that day was 48 degrees with a relative humidity of 80%. The skies were clear and the wind was blowing out of the ENE at 3 knots.

Personal Protective Equipment Evaluation

Fire Recruit Clarke was wearing full protective clothing including an SCBA. The typical Dallas Fire-Rescue protective ensemble was determined in a previous investigation to weigh 51 pounds. In addition, during his final trip up the stairs of the training tower Clarke had been carrying a Halligan tool weighing 12 pounds and a high-rise hose bag weighing 60-65 pounds. The exercise did not involve any live firefighting operations and there were no hazardous areas involved.

Medical Background of Victim

Recruit Clarke received a standard pre-employment physical examination on October 11, 2002 as required by Dallas Fire-Rescue. The physical included a review of Clarke's medical history and a complete physician assessment. All vital signs were within normal limits and no significant findings were noted in the physical examination. The examination included back X-rays, vision, hearing, drug, and alcohol testing. The physical examination does not include an electrocardiogram or exercise stress test. At the time of the physical, Clarke was 5' 7" tall and weighted 181 pounds.

The medical history questionnaire includes a family medical history section. Clarke did not indicate that anyone in his immediate family had any cardiac history. During his training as a fire recruit, Clarke did not indicate that he was experiencing any medical problems and was able to complete all physical training and firefighting evolutions.

The Dallas County Medical Examiner conducted an autopsy of Wayne Clarke on February 13, 2003. At the time of the autopsy, Clarke weighed 174 pounds. The only significant findings made during the autopsy was that Clarke's heart weighed 440 grams (normal 400 grams or less) and Clarke's left heart ventricle had a wall thickness of 1.0 cm (normal 1.3 cm or less) while the right ventricle wall measured 0.2 cm (normal 0.8 cm or less). Microscopic examination of heart tissue revealed myocyte hypertrophy and moderate medial thickening of intramyocardial arterioles. The Medical Examiner concluded that cardiac hypertrophy was the cause of Clarke's death.

Findings

There are no findings relevant to this investigation. Firefighter Recruit Clarke died as a result of a medical condition that is difficult to diagnose.

Recommendations

The following recommendations are based upon nationally recognized consensus standards for the fire service. Fire departments are not required by state statute to comply with these standards. All fire departments should be aware of the content of the standards and may develop programs based on them to increase the level of safety for fire department personnel.

- Fire departments should make every reasonable effort to screen firefighters for heart disease in an effort to reduce the number of sudden cardiac deaths.
- The State Fire Marshal's Office recommends that all fire departments use NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, as a guide for all fire protection operations.

NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, Chapter 10.1.3 states: "Candidates and members who will engage in fire suppression shall meet the medical requirements specified in NFPA 1582, *Standard on Medical Requirements for Fire Fighters and Information for Fire Department Physicians*, prior to being medically certified for duty..."

NFPA 1582, *Standard on Medical Requirements for Fire Fighters and Information for Fire Department Physicians*, states: "The combination of the physical stress of fire fighting and exposures for a person with preexisting coronary heart disease would be expected to increase the risk of a myocardial infarction or other acute event."

NFPA 1582 recommends a baseline electrocardiogram and exercise stress testing for firefighters over 40 years old.

Cardiac Hypertrophy and Sudden Cardiac Death

The Dallas County Medical Examiner provided the SFMO with information on cardiac hypertrophy from the U.S. Public Health Service. Cardiac hypertrophy is a form of cardiomyopathy, a disease of the heart muscle causing a loss of ability for the heart to pump blood. The cause of the disease is almost never identifiable. The heart tries to compensate with the loss of pumping ability by enlarging and stretching the pumping chambers. Arrhythmias may develop suddenly and lead to sudden cardiac death.

American Heart Association studies list hypertrophic cardiomyopathy (HCM) as the predominant abnormality occurring in about one third of cases of sudden cardiac death in young athletes. Current cardiac screening guidelines focus primarily on high school and collegiate athletes, but these recommendations may also be extrapolated to those engaged in strenuous careers concerned with public safety such as firefighters. The American Heart Association study states that early detection of clinically significant cardiovascular disease through pre-participation screening will in many instances permit timely therapeutic interventions that may prolong life.

Heart Association studies reflect that approximately 1 in 500 persons has hypertrophic cardiomyopathy (HCM). Pre-participation screening by history and physical examination alone (without noninvasive testing) is not sufficient to guarantee detection of many critical cardiovascular abnormalities in large populations of young trained athletes (and by extension, firefighters). Detection of hypertrophic cardiomyopathy by standard screening is unreliable because most patients have the non-obstructive form of this disease, characteristically expressed by only a soft heart murmur or none at all. Furthermore, most athletes with hypertrophic cardiomyopathy do not experience syncope or have a family history of premature sudden death due to the disease.

Cardiac hypertrophy is hard to diagnose early but a 12-lead electrocardiogram (ECG) has been proposed by researchers as a more practical and cost-efficient alternative to routine echocardiography for population-based screening. The ECG is found to be abnormal in about 95% of patients with hypertrophic cardiomyopathy.

NFPA 1582, *Standard on Medical Requirements for Fire Fighters and Information for Fire Department Physicians* recommends a baseline electrocardiogram. NFPA 1582 also recommends exercise stress testing for firefighters over 40 years old not having any coronary artery disease risk factors and age 35 for those with risk factors.