CLINICAL VIGNETTE

Risk of Cardiac Disease in Firefighters and Impact of Smoke Inhalation

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Introduction

A 36-year-old firefighter with 10 years of service and no significant medical history, presents to the ER with chest pain. He reports increasing fatigue and shortness of breath during physically demanding shifts. His yearly treadmill stress tests have remained normal, so he thought nothing of it. Prior to his ER visit he noted "10-15" episodes of chest pain with exertion, and at rest, with diaphoresis, palpitations, and dizziness. Although his personal medical history is negative, family history is significant for coronary artery disease in his father. His occupation exposes him to hazardous smoke and particulate matter over years. EKG on presentation does not show any ST abnormalities, and three high-sensitivity troponin tests done three hours apart, are negative. Due to persistent chest pain, a LEXISCAN cardiac stress test was performed. The test revealed small areas of decreased tracer uptake within the inferior septal and inferior mid to basal myocardium with pharmacological stress, compared to normal resting images. A coronary angiogram showed fifty percent stenosis in the left main artery, ninety-five percent stenosis in the distal left anterior descending artery, and ninety percent stenosis in the right coronary artery. Cardiothoracic surgery was consulted, and the patient agrees to triple vessel coronary artery bypass graft surgery.

Discussion

Several studies have reported heightened risk of cardiovascular disease (CVD) in firefighters. A 2013 study reported that firefighters have a significantly higher rate of heart disease than the general population.[1] A 2011 review reported firefighters who had experienced smoke inhalation were more likely to have elevated markers of inflammation, a known contributor to cardiovascular disease.[2] Firefighters face about a two-fold increased occupational risk. Firefighters regularly perform high-intensity, physically demanding tasks that can significantly increase heart rate and blood pressure with acute stress on the cardiovascular system. In addition to the physical job demands, firefighters are also exposed to a cumulative burden of cardiovascular risk factors including hypertension, and hyperlipidemia. The combination of stressors, including irregular sleep and the psychological stress of responding to emergencies, can exacerbate underlying heart conditions. This increases the risk of acute cardiac events, including myocardial infarction (MI) and sudden cardiac death (SCD).[3] Studies report that the incidence of SCD among firefighters is higher than that of the general population. Approximately 45% of firefighter fatalities are attributed to cardiovascular events.[4]

As well as the physical occupational burdens, firefighters are frequently exposed to hazardous smoke. Chronic exposure to toxins such as carbon monoxide, particulate matter, and polycyclic aromatic hydrocarbons, has been shown to increase risks of respiratory and cardiovascular diseases. Inhalation of carbon monoxide can impair oxygen delivery to tissues, including the heart, potentially leading to arrhythmias and ischemia.[2] Fine particulate matter (PM2.5) from smoke exposure has been linked to systemic inflammation and endothelial dysfunction, contributing to the development of atherosclerosis and other cardiovascular risk factors.[1]

Long-term exposure to these environmental and occupational hazards, particularly in the context of pre-existing cardiovascular risk factors, can accelerate development of coronary artery disease and increase likelihood of cardiac events.

Conclusion

Firefighters face a unique set of occupational hazards that place them at significantly increased risk for cardiovascular disease. In particular, the combined effects of physical exertion, occupational stress, and chronic smoke inhalation increase both acute and long-term cardiovascular risk. The exposure to toxic smoke and particulate matter from fires is particularly concerning, as it has been shown to promote systemic inflammation, endothelial dysfunction, and atherosclerosis. Given the higher incidence of heart disease and sudden cardiac death in firefighters, it is important to adopt comprehensive strategies to mitigate these risks. These include lifestyle interventions such as improving diet and managing physical activity and stress. Appropriate cardiovascular screening should be performed for this special population. Emerging screening tests including high sensitivity CRP, and lipoprotein profiles could be used to manage modifiable risk factors such as hyperlipidemia with early medication intervention. Newer imaging modalities, such as coronary calcium scans, and cardiac computed tomography angiography, could contribute to early detection of underlying heart disease that predispose firefighters to acute ischemic events. Finally, yearly stress tests should be considered in these high-risk patients. Special consideration to the type of stress test may be needed. The patient described had normal yearly EKG treadmill stress tests as well as initial EKG on acute presenta-

tion. More sensitive and specific cardiac testing may be more useful in these patients.

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