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Diagnostic Tests for Asthma in Firefighters In Bhuj

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ABSTRACT *Asthma is a common chronic inflammatory disease of the airways characterized by variable and recurring symptoms, reversible airflow obstruction and bronchospasm. Common symptoms include wheezing, coughing, chest tightness, and shortness of breath. A questionnaire, spirometry, direct and indirect airway challenge tests, exhaled nitric oxide, and skin-prick tests were administered prospectively to 50 out of 60 firefighters employed in Bhuj, India. Asthma was defined as the combination of respiratory symptoms with airway hyper responsiveness. Ten out of 50 firefighters (6%) had physician-diagnosed asthma, which could be confirmed in 4 firefighters. In contrast, asthma was diagnosed in 14% (14 of 50 firefighters). Wheezing was the most sensitive symptom for the diagnosis of asthma (sensitivity, 78%; specificity, 93%). Asthma was considerably underdiagnosed in firefighters. The combination of a structured symptom questionnaire with a bronchial challenge test allows to identify patients with asthma and should routinely be used in the assessment of active firefighters and may be of help when evaluating candidates for this profession.*

Introduction:
Asthma is a chronic disease involving the airways in the lungs. These airways, or bronchial tubes, allow air to come in and out of the lungs. If you have asthma your airways are always inflamed. They become even more swollen and the muscles around the airways can tighten when something triggers your symptoms. This makes it difficult for air to move in and out of the lungs, causing symptoms such as coughing, wheezing, shortness of breath and/or chest tightness.[1]

For many asthma sufferers, timing of these symptoms is closely related to physical activity. And, some otherwise healthy people can develop asthma symptoms only when exercising. This is called exercise-induced bronchoconstriction (EIB), or exercise-induced asthma (EIA). Staying active is an important way to stay healthy, so asthma shouldn't keep you on the sidelines. Your physician can develop a management plan to keep your symptoms under control before, during and after physicial activity.[2]

People with a family history of allergies or asthma are more prone to developing asthma. Many people with asthma also have allergies. This is called allergic asthma. Occupational asthma is caused by inhaling fumes, gases, dust or other potentially harmful substances while on the job.[3]

According to the leading experts in asthma, the symptoms of asthma and best treatment for you or your child may be quite different than for someone else with asthma.

The most common symptom is wheezing. This is a scratchy or whistling sound when you breathe. Other symptoms include:[4]

- Shortness of breath
- Chest tightness or pain
- Chronic coughing
- Trouble sleeping due to coughing or wheezing

Asthma symptoms, also called asthma flare-ups or asthma attacks, are often caused by allergies and exposure to allergens such as pet dander, dust mites, pollen or mold. Non-allergic triggers include smoke, pollution or cold air or changes in weather.

Asthma symptoms may be worse during exercise, when you have a cold or during times of high stress. Children with asthma may show the same symptoms as adults with asthma: coughing, wheezing and shortness of breath. In some children chronic cough may be the only symptom.[5]

An allergist diagnoses asthma by taking a thorough medical history and performing breathing tests to measure how well your lungs work. One of these tests is called spirometry.[5, 6] You will take a deep breath and blow into a sensor to measure the amount of air your lungs can hold and the speed of the air you inhale or exhale. This test diagnoses asthma severity and measures how well treatment is working.

An exacerbation of asthma during the execution of duty may put the subject as well as coworkers in potential danger. The definition of self-reported physician-diagnosed asthma used in epidemiologic studies relies on a positive answer to the questions, "Do you have asthma?" and "Has this been confirmed by a doctor?" This has the potential to underestimate the diagnosis of asthma. Guidelines for diagnosing asthma in firefighters do not incorporate different available tests for routine assessment unless specifically requested by the examining physician. It is known that there may be underreporting of symptoms at job recruitment to avoid exclusion from the job.[7]

In professions such as firefighting, it is important to have a highly sensitive objective tool to diagnose asthma. This study prospectively determined the diagnostic value of different respiratory symptoms, spirometry in the assessment of asthma in a cohort of firefighters.

Material & Method
The local municipal fire department employs 107 full-time firefighters. We excluded the records of the only female firefighter from the analysis. Firefighters were involved in

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all types of work when responding to an incident, so they were all exposed to similar conditions during work. Our study was approved by the local ethics committee. All subjects gave written informed consent.

Questionnaire
All participants answered a self-administered questionnaire with items of the Swiss Study on Air Pollution and Lung Diseases in Adults (SAPALDIA) I questionnaire,13 an extended version of the questionnaire used in the European Community Respiratory Health Survey (ECRHS).16 The questionnaire contained items about respiratory symptoms, living conditions, active and passive smoking, and occupational and leisure exposure to air pollutants.

Lung Function
Spirometry was performed using American Thoracic Society criteria.17A spirometer (EasyOne; ndd Medizintechnic; Zurich, Switzerland) was used to measure FVC and FEV1. The higher of two values for FEV1 repeatable to within 100 mL were recorded, and the percentage of predicted values18 was calculated.

Allergic Sensitization
Sensitization to allergens was measured by reactions to skin-prick tests on the forearm according to the protocol of the SAPALDIA.13 Nine different allergens or allergen mixtures were tested: mixture of six grass, mixture of three trees, the molds Alternaria alternate and Cladosporium herbarum, cat and dog epithelium, and the house dust mites Dermatophagoides pteronyssinus and Dermatophagoides farinae (ALK-Abello; Round Rock, TX). Histamine was used as the positive control and a saline/glycerol solution as the negative control. Atopy was defined as a positive response to at least one of the allergens tested.

Office spirometry was performed by GPs using a portable multifunction spirometer. Each of these spirometers is calibrated before being sold and does not need further regular calibration unless major damage occurs. GPs were previously trained on spirometry by reference specialists using the same type of device. No technical or interpretation problems were reported by specialists. Spirometry supplies were given free.

Statistical Analysis
Continuous variables are expressed as mean ± SD or as geometric means with interquartile range, and categorical variables are expressed as relative frequencies and percentages. A receiver operating characteristic (ROC) curve was plotted that allowed a graphical representation of sensitivity and specificity in order to view the best cutoff level for diagnosis of asthma. All tests were performed using software (SPSS Version 12; SPSS; Chicago, IL; and Excel; Microsoft; Redmond, WA).

Results
Fifty out of sixty male firefighters (95%) gave informed consent for this study. They were employed for a mean of 18 years (range, 2 to 36 years). Twenty out of the fifty firefighters (33%) were current smokers (mean, 20 pack-years).

Asthma was diagnosed in 10 of 50 subjects (14%). These subjects had cough and phlegm production but did not have wheeze in the last 12 months. They were considered to be positive to methacholine as well as to mannitol provocation test for the purposes of analysis.

Six firefighters (6%) stated that they had physician-diagnosed asthma. In four of these firefighters, this diagnosis could be confirmed and asthma was diagnosed. However, an asthma diagnosis was only reported by the board physician in two of them. The board physician is the only physician responsible for the preemployment screening and the regular medical check-up examinations for all the firefighters hired.

Two firefighters were classified as not having asthma. One firefighter was completely symptom free, and results of all administered tests to detect asthma were normal. The other firefighter complained of wheezing in the last 12 months and occasional nocturnal chest tightness. He was receiving asthma medication, had normal spirometry results, and had no AHR.

Discussion
Our study shows that asthma is considerably underdiagnosed in firefighters, and the best approach for a diagnosis is the combination of symptoms with a positive test result to mannitol challenge. Swiss firefighters undergo a medical screening program including spirometry prior to employment and also regular medical examination when in service to confirm the status "fit for duty." Physician-diagnosed asthma is often used to assign the diagnosis of asthma to a subject in an epidemiologic study setting or in a screening questionnaire at conscription.[8] This might not reflect the final diagnosis of asthma as has been shown in studies from the British and American armies. In the British army, Sinclair and coworkers found exercise-induced asthma in 29% recruits who had a history of probable asthma during childhood but had no symptoms and treatment during the last 4 years. Nish and Schweitz examined 192 recruits who failed a preenlistment exercise training test and had denied having asthma since the age of 12 years.[9] Fifty-nine percent of these recruits had asthma diagnosed subsequently based on further investigations. In our study, only 6% of firefighters reported a diagnosis of asthma; in two of them, the diagnosis could not be confirmed. The mean age of the firefighters as well as duration in the service were similar to literature reports. The diagnosis of asthma is important from the treatment perspective and also may affect work performance. It has been shown that firefighters who were fighting a fire had an increase in AHR when measured within 24 h after exposure. Furthermore, legal aspects have to be considered when firefighters with a diagnosis of asthma are exposed to risks.[7]

In clinical practice, the diagnosis of asthma often relies on a positive history of wheeze and other symptoms consistent with asthma such as cough and dyspnea. However, in a study by Baumann and coworkers, wheeze, cough, and dyspnea only occurred simultaneously in 36% of asthmatics.[10] Burrows and coworkers identified wheezing as the most frequent finding in a longitudinal study with patients with a recent diagnosis of asthma. Wheezing in the last 12 months was the most efficient symptom for the diagnosis of asthma.[11]

Although our study population was representative, including 95% of all firefighters of the municipal firefighting department, it can be argued that the group size is relatively small. Further studies are needed to confirm our findings in firefighters in other countries and in firefighters mainly engaged in hazardous material or wild land fire operations, and when firefighters undergo the different preemployment screening and regular check procedures.

We did not analyze data on work performance and medi-

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cal leaves in the firefighters;. It can be argued that although having asthma, these asthmatic firefighters are still in the active workforce and are therefore not suffering from a clinically relevant asthma. Further studies are needed to evaluate the influence of asthma on the work performance of firefighters. No doubt, findings will be based not only on host responses but on the types and intensity of fire and smoke exposures. Fire departments are not allowed to perform challenge tests in asymptomatic candidates who have a negative respiratory history, due to the discriminatory impact of false-positive test results. However, all candidates should undergo challenge testing if symptoms or history suggest asthma, even when baseline spirometry findings are normal.

In summary, asthma was considerably underdiagnosed in firefighters. The combination of a structured symptom questionnaire with the mannitol BCT allows to identify patients with asthma. Whether subjects without symptoms but with a positive mannitol challenge response have to be excluded from firefighting or should be treated with inhaled steroids has to be determined.

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