Occupational Asthma: Causes and Prevention

INTRODUCTION

Asthma is a chronic and long term lung disease mostly found in children but adult can have asthma too. Asthma is a common inflammatory disease of the airway of the lungs. It is characterized by variable and recurring symptoms, reversible airflow obstruction and bronchospasm. Asthma causes wheezing, breathless, chest tightness and coughing at early in the morning. Occupational asthma is type of asthma which is caused by exposure to some substance in the work place. Asthma triggering substances enhance asthma by the following reactions:

- An allergic reaction, in which some people with allergies of some substance develop allergic asthma, and
- An irritant reaction, in which when asthma patient smoke, histamine concentration increases in the lungs, resulting in asthma attack [1].

Asthma problem is commonly found among 10% adults. Definition is widely quoted “variable dyspnoea due to widespread narrowing of periphery passage of airway in the lungs, varying in severity of short period time or either spontaneously.”

Figure 1. Comparison of airways of lungs. [Retrieved from https://en.wikipedia.org/wiki/Brittle_asthma]
OCCUPATION AND ASTHMA

Any work, activity or environment where dust, vapour, and gases are inhaled are potential causes of lung disease, or may enhance pre-existing lung diseases.

Exacerbation of asthma:

Exacerbation of asthma involves exercise during working or exposure of cold, dust or irritant substances to which hyper responsive airway react. For eg., the exposure to sulphur dioxide concentration, even lower than the recommended occupational standards, can cause airway narrowing in people suffering from asthma [2].

Food processing and occupational respiratory allergy:

Occupational exposure to food is responsible for up to 25% cases of occupational asthma and rhinitis. During the processing of food additives, preservatives, antioxidants as well as contaminated food are the main sources of allergen. These allergens are high molecular weight proteins of animal and vegetable origin and are present in aerosolized foods. Most agents typically cause IgE mediated allergic reactions [3].

Occupational Asthma caused by Natural Rubber Latex (NRL):

The study of asthma allergy was done among the workers of NRL manufacturing and health care providers who use NRL gloves. It was found that NRL induce asthma to people who are involved in manufacturing and using it. After cutaneous, mucosal or visceral exposure, IgE mediated immunological response to protein allergens of NRL can cause immediate hypersensitivity reactions, which range from mild urticaria to life threatening anaphylaxis. However, NRL induced asthma should take a medical attention because it can lead to permanent functional impairment and occupational disability [4].

Occupational Asthma in Automotive industries:

Occupational asthma is also caused by powder paint which is used in automotive industry. Occupational asthma is characterized by variable airflow limitation and airway hyper responsiveness associated with inflammation, which results due to particular conditions of occupation. Diisocyanates are the most common agents of occupational asthma in the automotive industry. Powder paint is an alternate to solvent based spray painting and the triglycidyl isocyanurate. The organic acid anhydrides are identified as the main causal agents of occupational asthma. In addition to that, automotive industry uses powder paint which contains aluminium hydroxides, the exposure of which causes occupational asthma [5].

SYMPTOMS

The symptoms of occupational asthma are the same as the symptoms of non-occupational asthma. They are wheezing, coughing, chest tightness and shortness of breath. Asthma symptoms can come and go and some workers might not have all the symptoms. Those workers who have work related asthma problem, they should use Personal Protective Equipments (PPE) [6].
REASONS OF ASTHMA AND ALLERGIES IN WORK PLACE

The development of asthma has many different aspects such as environment and genetic makeup. Asthma is the most common chronic disease among children. The primary symptoms clearly seen at the age around five years in the form of wheezing and regular infection in the respiratory tract. Given below are the primary causes of asthma:

Allergies:
There exist a strong link between asthma and allergic substances. One study showed that the asthma is relatively common among older adults. The prevalence of asthma in patients with >60 years of age has been reported between 3.5 to 7.5% and also suggested that over 65 percent of adults with asthma are over the age of 55 years and 75 percent adults between the ages of 20 to 40 years have an allergy. The common source of indoor allergens is animal protein, which mostly come from cat and dog danders, dust mites, cockroaches and fungi [7].

Smoking Tobacco:
Tobacco smoking increase the risk of asthma, wheezing, respiratory infection and ultimately may results into death. People who smoke have a higher risk of developing asthma [1].

Environmental factors:
Air pollution can have greater impact on development and triggering asthma. Indoor air pollution can enhance the allergic reactions because indoor air pollution comprises mold or noxious fumes form household cleaners and paints. Asthma can be triggered in the home and outside home by agents such as pollution, sulphur dioxide, nitrogen oxide, ozone, cold temperature and humidity [1].

Obesity:
Some reports are available on the relation between obesity and asthma. The parallel increase in asthma with increasing obesity has led to conduct several studies, which examine the possible relationship between these conditions. These studies have analysed the trend in obese adults and found that BMI (Body Mass Index) increases universally among adults with asthma [1].

DIAGNOSIS OF ASTHMA

The main component which comprises an accurate asthma diagnosis are- medical history, observation, physical examination and breathing test. A primary level is to consult a physician. He will perform the asthma test; determine the level of asthma as mild, intermitted, moderate or severe in the people who are supposed to show signs of the condition; as well as identify the type of asthma. The person should know his/her family history of asthma and allergies as this information can help a doctor to make an accurate diagnosis [1].

The diagnosis of occupational asthma in working environment
It is important to know that which type of environment triggers asthma. Many asthma triggers can be found in the workplace. More than 250 known or suspected substance can cause or worsen asthma. A detailed history of occupational asthma and potential occupation exposures are important to know the
environmental trigger when evaluating an asthmatic patient. Although many patients will themselves be able to relate their symptoms to the workplace, many other cases of occupational asthma are recognized only because the physician performed a detailed environment history. Common questions for occupational asthma diagnosis are as follow: What is workplace exposure? When during the work shift or work week do symptoms develop? Do symptoms improve during the weekend and over vacations? Do other workers have similar symptoms? The history can be supplemented with material safety data sheets from the work place and can be compared with agents known to cause occupational asthma. A work sites visits by the physician or by the occupational hygienist might also provide helpful information. However, preparing a good occupational history is important in establishing link between symptoms and potential workplace exposure. History by itself is inadequate to make diagnosis of occupational asthma. To identify the health condition such as running nose, sinus infections, acid reflex, psychological stress and sleep apnea, there should be interference of asthma management.

**Physical examination:**

A physical test for asthma will generally focus on the upper tract, chest and skin. A doctor checks the sound coming from the lungs while you breath, listen sign of wheezing or high pitch whistle during breathing exhale by using a stethoscope. Wheezing sound is a key factor for obstructed air way and asthma.

Doctor need to check for running nose, swollen nasal passage, and soft growth inside the nose. He should also check the nose condition including eczema and hives. The person having allergy of some substance that leads to allergic conditions and over activity of immune system may be linked to asthma. During physical examination some people with asthma does not show physical symptoms.

**Asthma test:**

Lung function test is an alternative way for asthma diagnosis. In this test doctor measure how much air the person inhales and exhales and the speed with which a person can expel air from the lungs.

A spirometry test can provide an indication of lung function. Spirometry is a non-invasive test that require deep breaths and forceful exhalation into hose. The hose link to spirometry that show two key measurement:

1. Forced Vital Capacity (FVC) or the total amount of air a person can exhale during the FEV test.

2. Forced Expiratory Volume (FEV-1), the maximum amount of air person can exhale during forced breath in one second.

Doctors compare these values against what would be normal for another person of the same age. Value below normal indicate obstructed airways and probable of asthma.

A doctor will often administer a bronchodilator drug to open air passage before retesting with the spirometer to confirm the diagnosis. If results improve after using drugs, the risk of an asthma diagnosis increases.
Figure 2. A spirometry can help assess lung function [6]

Spirometry test for lung function is difficult to test children under 5 year of age. So in that case, diagnosis mostly rely on symptoms, medical history and other parts of physical examination process [1].

**Potential Triggers of Occupational Asthma In Work Sites**

Work related asthma is connected with exposure to work site irritants, allergens and physical conditions, which are called triggers. Given below are the examples of asthma triggers [8]:

- Animal Dander and insects
- Chlorine based Cleaning Products
- Cigarette Smoke
- Cockroach droppings
- Cold air
- Dust form wood, grain, flour, or green coffee beans
- Dust mites
- Gases such ozone
- Indoor dampness and mold

- Irritant chemicals
- Metal dust
- Physical exertion
- Pollen grain and plants
- Strong fumes
- Vapours from chemicals (eg., ammonia isocyanates and solvents)

**CLASSIFICATION OF WORK RELATED ASTHMA SUBSTANCES**

Asthma causing agents are classified by “Molecular Weight” (high, low, or both) of the agent, or by “Agent Category” that provides access to 12 different categories of agents [8].

Figure 3. Asthma substances [Retrieved from- https://www.cdc.gov/niosh/topics/asthma/causes_asthma.html]

1) Molecular weight
   - High molecular weight
   - Low molecular weight
• Both molecular weights
2) Anhydrides
3) Animal-derived
4) Baking allergens
5) Other Chemicals
6) Diisocyanates
7) Fluxes
8) Metals
9) Mold
10) Plants
11) Various wood dust or bark
12) Smoke

PREVENTIONS
The good method to prevent occupational asthma for workers is to control level of exposure to chemicals and other substance that may be sensitizer or irritants. These measures implement better control to prevent exposure and ensure clean working environment from asthma triggering substances, using less harmful substances. The use of Personal protective equipment (PPE) is mandatory to workers [9].

The best way to get relief from occupational asthma are-
• You may rely on meditation to relieve symptoms and minimize inflammation associated with occupational asthma.
• Smoking triggers asthma and lung cancer. By being smoke free may help prevent or reduce symptoms of occupation asthma.
• Asthma patients can take flu vaccination. This can help prevent illness. They must avoid non steroidal anti-inflammatory drugs and other medication that may make symptoms worse.
• Obesity also enhances asthma. Therefore, Lose weight. In those people who are obese, reduction in weight can lessen asthma symptoms and improve lung functions.

WHO CAN BE AT THE RISK OF HAVING OCCUPATIONAL ASTHMA
Worker in wide spectrum of work place ranging from bakeries to hospitals are at risk. Occupational asthma result from exposure to allergens and irritants in their jobs. This asthma can lead to new cases of asthma (new onset asthma) or worsen asthma (work aggravated asthma). More than about 250 substances are known to cause or exacerbate work-related asthma. These substances include many chemicals used in manufacturing industries such as paints, cleaning products, dust from wood industries, grain and flour, latex gloves certain molds, animals and insects [9].

ASTHMA MANAGEMENT AND TREATMENT

![Diagram](image)

Figure 4. Modelling of current asthma patient care pathway and stakeholder roles [10]
Figure 5. Modelling of expected asthma patient care pathway and stakeholder roles [10]

Asthma management is necessary in every organization. Prepare and standardized questionnaires’ for asthma control and written action plan should be there to improve patient adherence. Patient education through self-management, should be systematically provided during the follow up, either by network of stakeholder or by referring to a dedicated service. Patient should benefit from regular follow-up consultations and use of specific tools such as a peak flow meter or spirometry [10].

REFERENCES


