Health effects of occupational exposure: case study

A newly recruited employee at a furniture manufacturing plant has recently been complaining of cough, chest tightness and shortness of breath. Symptoms start soon after commencing work and continue throughout the day and night. They improve on the weekends but return as soon as he starts work again.

- What are the possible diagnoses and which is the most likely?
- What work-related factors could be involved?

Discuss the probable occupational condition in this employee, outlining pathogenesis, risk factors, clinical picture, diagnostic measures, preventative strategies and possible outcomes.

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Exposure to wood dust can lead or increase the risk for cancer of the respiratory system and the gastrointestinal tract. A fourfold increase in risk for sinonasal cancer was found among men involved in the manufacture of wooden furniture, and a twofold increase in risk for gastric cancer was seen in all of the component industries of basic wood-processing (Olsen, Moller and Jensen, 1988). Therefore, such diagnosis is not a recent phenomena but the result of ongoing epidemiology research over the past decades. Prolonged or repeated exposure to air contaminants such as wood dust and other chemicals related to wood furniture manufacturing such as wood glue, wood stain and spray painting can cause irritation to the respiratory system leading to occupational health disease.

Diagnosis

In this case study, a newly recruited employee at a furniture manufacturing plant is complaining of cough, chest tightness and shortness of breath. Such symptoms can be diagnosed by attempting to identify what is causing this uncomfortable feeling. Symptoms start soon after commencing work and continue throughout the day and night for five days to improve on the weekends when the employee is absent from work. These symptoms re-start again when he returns to work on Monday. To diagnose such symptoms one must be aware of the possible hazards one is exposed to and by having an indication of what could be causing the distress to the employee.

Kuruppuge, (1998) argues that the health effects of occupational exposure to wood dust can be summarized under five categories:

- toxicity (including dermatitis and allergic respiratory effects)
- non-allergic respiratory effects
- sinonasal effects other than cancer (nasal mucociliary clearance and mucostasis)
- nasal and other types of cancer
- lung fibrosis

Medical diagnose will show that these symptoms are work related since symptoms started straight after employment and were not felt priory, that they improve when off from work and that they re-occur on returning back to work. This can be confirmed clinically by objective testing by taking measurements of the lungs function before and during work shift. Such testing is called Peak Expiratory Flow (PEF) and will determine if such symptoms are caused by being exposed to occupational hazard at the place

of work. PEF rate measurement shows how much patients can blow out of their lungs in one breath and it is useful especially when they are having a flare up of their respiratory disease such as occupational asthma (OSCE Skills, 2013).

The duties assigned to this employee are unknown. However, it is irrelevant since the durance of exposure and dose amount are causing such symptoms and not the job itself. The job assigned could be a clerical one and not necessarily a trade job, but if the employee is being exposed to chemicals or wood dust, then it is the working environment that is unhealthy.

Work Related Factors

One of the most common toxicity manifestations from inhaled agents in industrial exposures is the irritation of the airways, resulting in breathing difficulties and even death for the exposed individual (Dallas, 2000). Being exposed to wood dust and chemicals related to wood furniture manufacturing at all stages of wood processing can cause pain symptoms which can be of a detriment to both upper and lower respiratory tract. For many years, wood dust was considered to be an irritant dust that irritated the nose, eyes, or throat, but did not cause permanent health problems (Work Place Alberta, 2009). However, epidemiology research studies show that exposure to wood dust for a long term might lead to allergies and cancer. Wood dust is a potential health hazard since wood particles from processes such as sanding and cutting become airborne. Breathing these particles for a long period of time may cause allergic respiratory symptoms, mucosal and non-allergic respiratory symptoms, and cancer. Toxic chemicals

that are used for furniture manufacturing are also detriment to occupational health. These chemicals can be absorbed into the body through the skin, lungs, or digestive system and cause effects in other parts of the body. The major wood working processes are debarking, sawing, sanding, milling, lathing, drilling, veneer cutting, chipping, mechanical defibrating and wood stain or spray painting. From the tree felling stage onwards through the various stages of wood working and manufacturing processes, workers are exposed to airborne hazard. Many individuals develop asthma following workplace exposure, and some asthmatics suffer additional provocation following the inhalation of certain industrial toxins and the inhalation of wood dusts, for instance, has been implicated in both situations (Dallas, 2000).

Risk Factors

Wood work operations generate dusts of different particle sizes, concentrations, and compositions. Particle-size distribution studies have shown that the major portion of airborne wood dust is contributed by particles larger than 10 µm size which can be trapped effectively in the nasal passages on inhalation and for which inhalable mass sampling is mostly appropriate. Inhalable Particulate Matter (IPM) sampling is the environmental measurement which is most closely predictive of the risk of developing nasal cancer (Hinds, 1988). According to the ISO (International Standard Organization), inhalable dust is defined as the mass fraction of total airborne particles which is inhaled through the nose and mouth (ISO, 1995).

Pathogenesis & Clinical Pictures

The human respiratory system is a series of organs responsible for taking in oxygen and expelling carbon dioxide. In occupational Health, diseases and conditions of the respiratory system can be caused by the inhalation of foreign objects such as fine dust chemicals, allergens and other irritants. The human respiratory system has neutral mechanism against airborne hazards. (Dallas, 2000) explain in detail that the nose has fine hair as front line barrier filter for dust which is not greater than 5 femtometer (Fm). The trachea, also called the windpipe, filters the air that is inhaled. It branches into the bronchi, which are two tubes that carry air into the lungs. This fine dust is trapped in the nose, trachea and main bronchi and it can be cleared by coughing and by special body cells that destroy bacteria and viruses. However, dust which is finer than 5 Fm will go deeper in the lungs, reaching the bronchioles, alveolar ducts known as alveoli and settle there. These will likely to cause hypersensitivity reactions-occupational asthma or hypersensitivity pneumonitis (inflammation of the walls of the air sacs and small airways), permanent obstructive disease and diffuse lung fibrosis which might lead to occupational asthma or cancer in the respiratory tract system. Hypersensitivity pneumonitis appears to be triggered when small particles penetrate deeply into the lungs where they trigger an allergic response (Work Place Alberta, 2009). Both (Kuruppuge, 1998) and (Dallas, 2000) describe that initial effects can develop within hours or after several days following exposure and are often confused with flu or cold symptoms (headache, chills, sweating, nausea, breathlessness, and other fever symptoms). Tightness of the chest and breathlessness often occur and can be severe. With exposure over a long period of time, this condition can

worsen, causing permanent damage to the lungs. The walls of the air sacs thicken and stiffen, making breathing difficult.

Occupational asthma develops only after an initial symptom free period or exposure, which causes breathing difficulties due to inflammation of bronchi and bronchioles. This causes a restriction in the airflow into the alveoli. Two types of allergic reaction can take place in the lungs. Decreased lung capacity is caused by mechanical or chemical irritation of lung tissue by the dust. This irritation causes the airways to narrow, reducing the volume of air taken into the lungs and producing breathlessness. It usually takes a long time to see a reduction in lung capacity. Chronic Obstructive Pulmonary Disease (COPD) is the intersection of three related conditions such as chronic bronchitis, chronic asthma, and emphysema which is a progressive disease that makes it very difficult to breathe (Zimmermann, 2012).

Prevention measures to improve plants and possible outcome.

In practice, there must be a distinction between the different types of wood dust and chemicals that is usually used. This is particularly the case for smaller craft businesses in Malta which the types of work and types of wood and working materials are constantly changing, and many different activities take place in a small area. The risk factor hazard should be minimized to zero and personal protective equipment should be the last resort as outlined in the European framework directive (Directive 89/391 EU, Art. 6). The employer must take all the necessary measurements to focus on the general reduction of dust levels as bound by L. N. 36 of 2003, Articles 4, 5 and 6. This objective has to be pursued regardless of the potential cancer risks as dust

and chemicals carry a general risk to health, since it also influence the work flow and product quality.

The employer must make a precise analysis of the existing risks and should record all the influencing factors, questioning the workers about their situation, their experiences and their proposals. On this basis, measures should be established for improving the working environment. Employees are obliged to follow all the strategic occupational health and safety procedures as outlined in L. N. 36 of 2003, Art. 15.

The hierarchy of measures defined in Article 6 of the EU Directive 89/391 is as follows:

a. Evaluating the risks which cannot be avoided,

b. Combating the risks at source,

c. Adapting to technical progress,

d. Developing a coherent overall prevention policy which covers technology, organization of work, working conditions, social relationships and the influence of factors related to the working environment,

e. Giving collective protective measures priority over individual protective measures,

f. Giving appropriate instructions to the workers.

The scope of these strategic measures is to encourage and ensure improvements in the health and safety of workers at work through the

prevention of risks, the promotion and safeguard of occupational health and safety, and through the elimination of those risks and factors which are likely to cause accidents at work as outlined in L. N 36 of 2003 of the Occupational Health and Safety Act.

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