Chapter 2.1 : Introduction

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General objectives

Knowledge objectives :

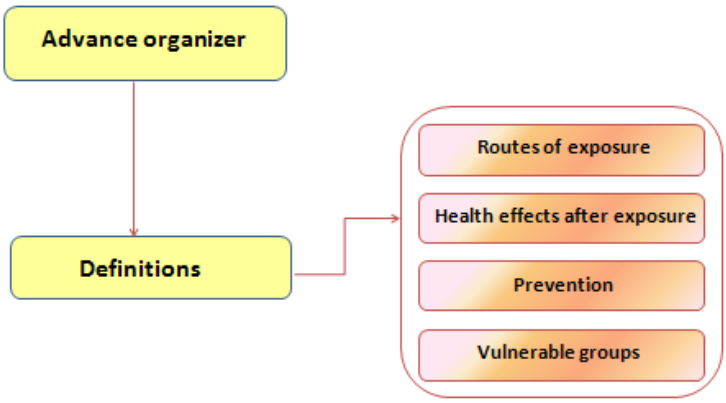
- The student describes the ways how hazardous agents enter the body
- The student explains the acute, chronic as well as the local and systemic effects of the most common workplace hazards
- The student gives examples of occupations and workplaces where (specific) hazards can be found
- The student discuss several methods of preventing and controlling exposure in the workplace

Skills/attitudes related objectives :

- The student recognizes early symptoms and adverse health effects of workplace exposure to different hazardous agents
- The student gives special attention to susceptible persons and vulnerable groups
- The student advices on collective and personal preventive measures related to exposure
- The student finds reliable information with information and evidence about typical work related risks, health effects and preventive measures.

Concept Map

Framework



European Module
EMUTOM
for Undergraduate Teaching of Occupational Medicine

Advance organizer

Case 1 : Acute lead intoxication in a female battery worker : Diagnosis and management

George Dounias, George Rachiotis, Christos Hadjichristodoulou

Journal of Occupational Medicine and Toxicology 2010, 5:19
http://www.occup-med.com/content/5/1/19

Abstract
Lead is a significant occupational and environmental hazard. Battery industry is one of the settings related to lead intoxication. Published information on the use of oral chelating agents for the treatment of anaemia in the context of acute lead intoxication is limited. The patient was a 33 year immigrant female worker in a battery manufacture for 3 months. She complained for malaise that has been developed over the past two weeks. Pallor of skin and conjunctiva was the only sign found in physical examination. The blood test on admission revealed normochromic anaemia. Endoscopic investigation of the gastrointestinal system was negative for bleeding. The bone marrow biopsy was unrevealing. At baseline no attention has been paid to patient's occupational history. Afterwards the patient's occupational history has been re-evaluated and she has been screened for lead intoxication. The increased levels of the lead related biomarkers of exposure and effect confirmed the diagnosis. The patient received an oral chelating agent and an improvement in clinical picture, and levels of haematological and lead related biochemical parameters have been recorded. No side effect and no rebound effect were observed. This case report emphasizes the importance of the occupational history in the context of the differential diagnosis. Moreover, this report indicates that lead remains a significant occupational hazard especially in the small scale battery industry.

Case 2 : Latex-Induced Occupational Asthma in a Surgical Pathologist

Judith Green-McKenzie, Debra Hudes

Environmental Health Perspectives 2005,113:888-893
doi: 10.1289/ehp/7830 available via http://dx.doi.org/

Abstract
CONTEXT: Latex allergy and sensitization have been an important problem facing health care workers. Providing a latex-safe environment is the intervention of choice.

CASE PRESENTATION: A 46-year-old surgical pathologist presented with increasing shortness of breath for the previous 4 years. Twenty years before presentation, he noted a pruritic, erythematous rash on his hands, associated with latex glove use. Fourteen years before presentation, during pathology residency, he developed a nonproductive cough, wheezing, and an urticarial rash, temporally associated with use of powdered latex gloves. These symptoms improved while away from work. At presentation, he had one-flight dyspnea. His skin prick test was positive for latex, and pulmonary function testing showed mild obstruction, which was reversible with bronchodilator use. Because the patient was at risk for worsening pulmonary function and possible anaphylaxis with continued exposure, he was removed from the workplace because no reasonable accommodation was made for him at that time.

DISCUSSION: The patient's presentation is consistent with latex-induced occupational asthma. Initially noting dermal manifestations, consistent with an allergic contact dermatitis secondary to accelerators present in latex gloves, he later developed urticaria, flushing, and respiratory symptoms, consistent with a type I hypersensitivity reaction to latex. He also has reversible airways disease, with significant improvement of peak expiratory flow rate and symptoms when away from work.

RELEVANCE TO CLINICAL OR PROFESSIONAL PRACTICE: The ideal treatment for latex sensitization is removal from and avoidance of exposure. Clinicians should consider occupational asthma when patients present with new-onset asthma or asthmatic symptoms that worsen at work.

Case 3 : Vet dies from pneumonia in avian flu case

Tony Sheldon

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doi: 10.1136/bmj.326.7396.952/h

The Dutch government has ordered an independent investigation into the rare death of a veterinary surgeon from pneumonia after infection with avian flu virus. Until now the worst effect that this virus has had in infected people has been conjunctivitis.

The National Influenza Centre, part of Rotterdam's Erasmus Medical Centre, has already confirmed that the strain of virus was identical to avian flu virus and not a mutant strain such as the strain that caused deaths during the 1997 outbreak of avian flu in Hong Kong.

The 57 year old vet became ill within days of visiting a poultry farm hit by the current avian flu outbreak that is affecting the Netherlands and Belgium. The same avian flu virus, A/H7N7, that has infected poultry in the region was identified in his lungs. He had no other illness, so avian flu is the likely cause of death.

The outbreak management team has advised everyone who was in close contact with the vet—including doctors and nurses who treated him, pathology staff, and his immediate family—to take the antiviral drug oseltamivir (Tamiflu). The vet himself had not taken any antiviral treatment.

Guidelines issued last month advised people in direct contact with infected poultry—such as farm workers involved in culling or people who live, work, or visit infected farms for long periods—to wear protective clothing and take antiviral treatment. Such people are also being vaccinated against the human flu virus H3, to avoid coinfection.

The Healthcare Inspectorate has now written to all general practitioners repeating the guidelines and advising that oseltamivir can be prescribed up to seven days after the last contact with infected poultry. The National Coordination Centre for Communicable Disease Control is alerting doctors to flu-like symptoms, and agricultural workers have been recruited throughout the Netherlands to deal with the outbreak.

Data from the National Institute of Public Health and the Environment show that since 4 March 332 people have had health problems associated with the outbreak. Of these people 266 had conjunctivitis and 78 tested positive for A/H7N7. Many infected people are believed to be poultry workers who failed to protect themselves adequately.

Albert Osterhaus, professor of virology at the Erasmus Medical Centre, said: "The most important message is that the virus should be regarded as a human pathogen which we have to take seriously. That is why we have implemented a whole package of measures to preventively treat everyone involved in the cull."

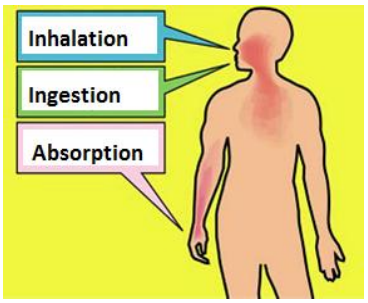
Though deaths from avian flu are rare, Professor Osterhaus warned: "We just do not know how serious the H7N7 virus is, so we have to be very cautious."

1. Definitions and general principles

1.1. Routes of exposure

The human body has natural defence systems and protective barriers against the environment outside the body (e.g. chemicals, micro-organisms, extreme temperatures,…) . However, the defence systems may be weakened and the barriers are liable to damage. In the workplace, a variety of hazardous agents are present and under certain conditions, they may enter the body. The most common routes of entry are :

1. through the respiratory tract via inhalation
2. through the digestive tract via ingestion
3. through the skin via dermal absorption



Inhalation is the most important route for hazardous substances. A number of mechanisms protect the lungs (such as hairs in the nose, mucus in the mouth) and filter the pollutants that are present in the air you breathe. Other mechanisms which can act as warning signals include smell, simple coughing, sneezing and a runny nose. Nevertheless, many pollutants may be inhaled and deposited in the lungs, and, if they are soluble, they can be absorbed.

Ingestion happens when a hazardous agent is swallowed. It also occurs through eating or smoking with contaminated hands or in contaminated work areas. The body has also ways of protecting the digestive system. For example, unwanted material can be vomited through the mouth, or rapidly excreted through the bowels (as in the case of diarrhea). Some ingested hazardous are neutralized in the stomach, however, others are absorbed into the bloodstream and taken into the body cells.

Dermal absorption: the skin, which protects the body from contaminants outside the body is another major route of entry. Chemicals can be absorbed (taken into the body) through healthy skin. Exposure to biological and physical agents can result in skin infections and injuries.

Other ways people come into contact with hazardous substances include injection (sharp material, needle) and absorption through the eye (splash).

Keep in mind :
- Toxic materials may enter the body by more than one route
- Several other factors affect the inhalation, the absorption or ingestion of toxic substances such as the concentration of the product, the exposure time, the chemical and physical form and properties, the condition of the respiratory tract and skin,…
(See the following subchapters for more details)

1.2. Health effects after exposure

a) Local and systemic effects

a. *Local effect* : refers to an adverse health effect that takes place at the point or area of contact. Local effects are seen at or near the body part or parts where exposure occurred. Absorption does not necessarily occur. For example, inhaling particles can result in irritation of the

respiratory tract, resulting in effects ranging from sneezing to chest pains and difficulty in breathing. An ant bite leads to redness and swelling at the bite location.

b *Systemic effect* : refers to an adverse health effect that takes place at a location distant from the body's initial point of contact. Some substances are absorbed into the bloodstream and are then carried to other parts of the body, where they cause their effect. These types of substances often have "target organs" in which they accumulate and exert their toxic effect. Examples: effects of lead on the bone and the nervous system; benzene effects to the bone marrow.

b) Acute and chronic effects

a. *Acute effects* : are characterized by sudden and severe exposure and rapid absorption of the substance. The body reacts by producing an immediate obvious response. Acute health effects often disappear soon after the exposure stops and are often reversible. Examples: the nausea, headache or vomiting a worker might experience after using a solvent to clean auto parts.

b. *Chronic effects* : are characterized by usually prolonged or repeated exposures over many days, months or years. Symptoms may not be immediately apparent but appear after a long time because of the diseases' latency period. Chronic conditions such as cancers may take 20 to 30 years to develop. Chronic health effects are often irreversible. Examples: mesothelioma after asbestos exposure.

While exposure to some hazards only causes either an acute or a chronic response, exposure to other hazards — such as formaldehyde and noise — can cause both kinds of effects. Short-term exposure to formaldehyde may cause headaches or eye irritation (acute effects), while long-term exposure may cause recurring allergic skin reactions or cancer (chronic effects). Short-term exposure to loud noise may cause ringing in the ears, while long-term exposure may cause permanent hearing loss. Solvents can also produce both acute and chronic effects on the nervous system.

Local, systemic, acute and chronic health effects can all result from exposure to one substance. For example, if a worker drinks too much alcohol, these are the possible effects that can result:

- Local effects - stomach irritation and stomach upset
- Systemic effects - an increase in the blood alcohol level, which can cause damage to brain cells
- Acute effects - drunkenness, headache and a hangover
- Chronic effects - permanent liver damage, which can have a latency period of many years

1.3. Prevention

Treating a disease in its earliest stages can be relatively easy, sometimes requiring little more than a simple prescription. But helping a patient combat the effects of an advanced and chronic disease can prove extremely difficult, and sometimes impossible. By shifting the focus from treating health problems to preventing them, workers can enjoy healthier, more active lives.

a) Preventive health care

Preventive medicine strategies are typically described as taking place at the primary, secondary, and tertiary prevention levels.
Primary prevention : methods to avoid occurrence of disease
e.g. in general health care : the use of condoms to prevent sexually transmitted diseases
e.g. in an occupational setting : Hepatitis B vaccination in healthcare workers

Secondary prevention : methods to diagnose and treat disease in early stages before it causes significant morbidity
e.g. in general health care : a doctor checking for suspicious skin growths is an example of secondary prevention of skin cancer
e.g. in an occupational setting : annual health surveillance with biological monitoring of workers exposed to chemicals
Tertiary prevention : methods to reduce negative impact of disease by restoring function and reducing disease related complications
e.g. in general health care : stroke rehabilitation programme
e.g. in an occupational setting : relocate a worker with occupational asthma to a job without exposure to the responsible allergen

b) Hazard prevention and control

A hazard prevention and control programme is simply what steps you are going to take to remove a hazard completely (eliminate) or at least reduce it to a low level (minimise). The general principles of prevention should be considered; there is a hierarchy of controls that set out how to manage hazards. When controlling a hazard, first consider methods to eliminate the hazard or substitute a less hazardous method or process. If this is not feasible, engineering controls such as machine guards and ventilation systems should be considered. This process continues down the hierarchy until the highest-level feasible control is found. It is always better to control the hazard as close to the source as possible. Reliance on personal protective equipment (PPE) should be one of the last steps in the process (not the first). Often a combination of controls is most effective.
Other important methods of prevention are personal hygiene and ensuring workers have access to washing facilities, food storage and eating areas that are away from their work areas.

Prevention hierarchy :
- Eliminate the risk
- Substitute : replace the risk with safer alternatives
- Combat the risks at source by engineering controls (separate people from the harm, guards, interlocks etc.)
- Administrative controls, limit entry or time spent in a hazardous area by job planning, rotation and scheduling, changes to work procedure, and similar measures.
- Provide collective protection
- Provide personal protective equipment
- Provide training
- Signage – warning

1.4. Vulnerable groups

Vulnerability is the degree to which a population, individual or organisation is unable to anticipate, cope with, resist and recover from the impacts of hazards and disasters (Environmental health in emergencies and disasters: a practical guide. WHO, 2002).

Vulnerable persons may be unable to take care of themselves, or protect themselves from harm or from being exploited. This may be because they are minors, have some form of illness, a disability, an impairment, are old, or are pregnant women.

Young people are still in full growth and chemicals may interact with their physical and mental development. In addition, they usually do not realise the danger because they have not much insight into safety and they are inexperienced or inadequately trained. With increasing age, the work ability

and health of the worker may deteriorate. Physical changes occur e.g. changes in hearing and vision, muscular strength, as well as changes in mental capacity and all these may affect performance at work. Pregnant women may be exposed to substances or processes that cause reproductive health damage.

In recent years, attention has been given to other types of vulnerable groups such as temporary workers, home workers and telecommuters. They are at risk, not because of their personal characteristics but because of the specific precarious status in which they work. Each form of precarious work may offer its own challenges but they all share the same disadvantages: low wages, few benefits, lack of collective representation, and little to no job security.

Vulnerable persons can still participate in work; however, they need special protections such as:
- educate and actively encourage these groups of workers to adopt sound preventive and control practices
- make safer technologies readily available
- temporary or definitive adjustment of working conditions or hours
- relocation to a different job,…

Key words

Absorption
Acute effect
Chronic effect
Exposure route
Ingestion
Inhalation
Local effect
Prevention
Systemic effect
Vulnerable groups

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2. http://actrav.itcilo.org/actrav-english/telearn/osh/body/yourbody.htm International Labour Office (ILO)