## **OCCUPATIONAL HEALTH**

## ✓ **Definition:**

 World health organization (WHO), define occupational health as <u>the</u> <u>promotion and maintenance of the</u> <u>highest degree of physical, mental and</u> <u>social well-being of workers in all</u> <u>occupations.</u>

- Occupational health services are concerned mainly with:
- <u>health promotion and protection</u> of all workers as well as,
- provision of curative services for cases of disease amongst them.

 It is estimated that a lost working one day of a simple manual worker in Egypt causes a loss of production equals to about 537 Egyptian pound.

#### **Work and health:**

• Work may have an adverse impact on health, but it may also be beneficial to health and well-being.

• On the other hand, the health status of the workers is reflected on their work.

 Accordingly for correct diagnosis of any patient it is important to ask him about his <u>occupation and exposure</u> before asking him about his complaint.

 Occupational diseases occur as a result of exposure to <u>physical</u>, <u>chemical</u>, <u>biological or psychosocial</u> <u>factors</u> in the workplace.

## **Work-related diseases**

• Some other diseases where work conditions or stress can play a role in their occurrence, these are called work-related.

• These diseases are also frequently seen in the general community.

#### • Examples of work-related diseases are:

- Hypertension.
- Ischemic heart disease.
- Psychosomatic illness.
- Musculoskeletal disorders.
- Chronic non-specific respiratory diseases/ chronic bronchitis.

• In these diseases, <u>work may be a factor</u> in its causation or may <u>aggravate a pre-existing</u> <u>condition</u>.

## **Occupational diseases:**

- These are:
  - ✓ cause-specific,
  - occurring mainly among working population,
  - exposure at workplace is essential,
  - ✓ notifiable and
  - ✓ compensable.

## **Components of Occupational Health**

## **Services**

- Medical
- Environmental

## ✓ <u>Medical:</u>

- They are carried by <u>occupational physician(s)</u>, <u>nurse(s)</u>, and <u>technician(s)</u>:
- Pre-employment medical examination.
- Periodic medical examination.
- First aid and management of emergencies.
- Treatment of common diseases and causalities.
- Health education.
- Care of workers nutrition.
- Records and statistics.
- Control of communicable diseases.

#### ✓ Environmental:

• They are carried by occupational hygienist(s) (engineer or chemist), social worker :

- <u>Periodic monitoring of different types of</u> <u>exposure</u> and assure that exposure at the work places don't exceed the allowable levels or concentration.

- Advice how <u>to ameliorate the working</u> <u>condition</u> as illumination - ventilation housekeeping etc.... - Advice how to adopt and ameliorate the interpersonal relation-ship to be cooperative rather than competitive (In developed countries psychological work stress is now the most important occupational exposure).

## - Ergonomics:

✓ It is an applied science concerned with designing and arranging things people use so that the people and things interact most efficiently and safely (fitting a job to a person) and

 helping <u>lessen muscle fatigue</u>, increasing productivity and reducing the number and severity of workrelated MSDs).

# General methods of prevention of occupational diseases

- The main aim of preventive measure is to:
- Eliminate the <u>HAZARD</u>, if this is not possible,

- Then we try to: eliminate the <u>RISK</u> i.e. eliminate the possibility that the <u>HAZARD</u> can induce health effects. <u>A hazard</u> is a potential source of harm or adverse health effect on a person or persons (<u>Something that can cause harm</u>).

• <u>Risk</u> is the <u>likelihood</u> that a person may be harmed or suffers adverse health effects if exposed to a hazard (It is the <u>chance</u>, high or low, that any hazard will actually cause somebody harm).

## HAZARD Anything that can cause harm (eg. a chemical, electricity, ladders, etc)

RISK How great the chance that someone will be harmed by the hazard

## 1) Environmental (engineering) measures:

## > <u>Substitution:</u>

 Substitution of hazardous substances or operation by non-hazardous ones or e.g., fiberglass in place of asbestos, compression instead of hammering.

## ><u>Isolation:</u>

 Isolation of the hazardous process inside the work places so that other surrounding workers are not affected e.g. isolation of radiation or noise sources.

#### Segregation:

• Segregation of the hazardous process from the work place. e.g. incinerators.

## > Ventilation:

- By <u>fans</u> to increase air movement or by <u>exhaust system for suction</u> of toxic gases or dust to be collected in a special disposal system.
- Dust control systems
- Environmental monitoring:
- To assure that exposure at the work places don't exceed the allowable levels.

## Assurance of ergonomics in the work place:

- To adapt the work situation to the physical capabilities of the workers.
- Amelioration of the interpersonal relation-ship
- By social worker specialized in work sociology science

## 2) Medical measures:

## Occupational oriented pre-employment medical examination

## Periodic medical examination which aims at:

- Early detection of health effects of hazardous exposure to be treated in its reversible stage.
- Monitoring the efficiency of occupational heath services.

## Personal protective devices:

• To prevent the penetration of the uncontrolled hazardous exposure in the body e.g. masks for dust or gases exposure, earplugs for noise exposure, leaded aprons for radiation exposure etc.

•Protective devices must be <u>suitable</u>, <u>comfortable</u>, <u>don't interfere with job</u> <u>continuity</u> and <u>periodically maintained</u> otherwise it will not be used.



 Workers should be informed about the hazards of his job and how to avoid the health effects of such hazards.

## **Occupational hazards**

> <u>Physical:</u> The main physical hazards in industry and other occupations are: Noise - heat radiation (ionizing and non ionizing radiationchanges of pressure - vibration - electricity electromagnetic waves - microwaves.

Chemical: Gases, metals and dust (organic and inorganic).

Mechanical: Lack of ergonomics and accidents.
<u>Biological:</u> Bacteria, viruses, parasites and fungi.

## **Noise**

Noise is defined as the un-wanted sound.
Physically noise can be <u>classified</u> according to its duration as:

<u>1-Continuos noise</u>: as in spinning and waving industry.

**<u>2- Interrupted noise</u>: as air compressors -**Air port and traffic noise.

<u>3- Impulse and impact noise</u>: as sounds of explosions.

• Noise is measured by <u>a sound level</u> <u>meter</u>, the unit of measurement is the <u>decibel</u>.

• Occupational exposure to noise occurs in most of industries examples are:

- ✓ iron and steel industry,
- ✓ spinning and waving industries and
- ✓ electric generators.

# Noise has both auditory and non-auditory effects.

## 1- Auditory effect:

- Exposure to noise causes destruction of the hair cells of the organ of Corti in the inner ear.
- This leads to insidious and gradual progressive loss of hearing.

#### **Diagnosis of noise induced hearing loss:**

Occupational history should indicate exposure to high intensity noise (more than 85 dB) for a sufficient duration (years).

- Difficulty of hearing especially for highpitched sounds.

## 2- <u>Non-auditory effects</u>:

- Insomnia if noise exposure is at night.
- Lack of communication with others.
- Lack of concentration

#### **Prevention:**

## **<u>1- Environmental measures</u>:**

- Substitution of noisy machines or noisy operation by less noisy ones.

- Segregation of noisy machines in a remote place.
- Isolation of the noisy machines with noisy proof materials.
- Diminution of intensity of exposure to a maximum of 85 dB

## **2- Medical measures:**

- Periodic measurement of hearing level.
- Use of earplugs or earmuffs.

## **Heat disorders**

- <u>Heat balance</u>:

Normally the body is in state of equilibrium between <u>heat gain</u> and <u>heat loss</u> resulting a relatively stable temperature of 37°c. <u>Heat gain through:</u>

- Metabolism: it increases according to effort.
- Radiation: from sun or hot objects.
- Conduction: by touching hot objects.

## **Heat loss through:**

- Evaporation: of sweat (most important in heat stress).
- Radiation: (during rest no heat stress).
- Conduction: touching cold objects (minimal role).

## **Accordingly:**

- Body temperature =  $M \pm R \pm C E$
- This is called heat balance equation.

#### **Occupational exposure to heat:**

1-Exposure to dry heat as working in front of oven e.g. in iron and steel industry, glass industry, baking, cooking, foundries, welding, metallic industries, fire men.

2-Working in situations with increased humidity as in hot countries at the sea and in laundries.

**3-** Direct exposure to sun as working in the desert.

4- Working in badly ventilated closed places which leads to non replacement of the surrounding air.



• Heat exposure exceeding the comfortable zone causes heat stress.

• Failure of the body to cope with such stress causes heat disorders.

## 1- <u>Heat syncope</u>

 Heat stress specially if accompanied with psychological stress leads to vasodilatation of blood vessels leads to decreased blood pressure and decreased blood flow to the brain and syncope.

• Treatment: patient should be removed from the hot environment, the head must be lowered, supply fluids, assure the patient.
#### **<u>2-Heat cramp</u>**

- Painful spasm of voluntary muscles is following hard physical work in hot environment.
- Increased sweating causes <u>loss of water and NaCl</u>, compensation for water only ------ dilution of NaCl in blood ------ decrease of osmotic pressure of blood ------transfer of water into muscle fibers----- irritability ------ cramps.
- These cramps occur in the muscles most active during the heat exposure e.g. calf muscles among football players' - biceps muscles among bakers.

### 3- Heat exhaustion

There are two main types of heat exhaustion.

### a-Water depletion heat exhaustion:

- This occurs in situations where drinking water <u>is not sufficient</u> to compensate for the water loss of sweating.
- The result of water depletion is failure to maintain <u>adequate circulation</u> to preserve and continue the different body functions.
- Sever stages may account to sever fatigue, delirium and coma.

#### **b-Salt depletion heat exhaustion:**

- This occurs in situations where intake of salt is not sufficient to compensate for the water loss of sweating.
- This may lead to disturbed osmolarity of the blood, which accounts to sever fatigue, muscle cramps and coma.

Treatment is mainly to compensate for the lost element.

#### 4- Heat stroke

• A state of thermo-regulatory failure of sudden onset following exposure to hot environment characterized by disturbance of CNS, generalized anhydrosis, rectal temperature above 40.6C.

• The condition is frequently fatal.

## The essential triad of rapid diagnosis is:

1- Rectal temperature above 40.6C.

2-loss of consciousness.

3- Red hot dry skin.

## > Heat hyperpyrexia:

- It differs from heat stroke is that the patient is:
- conscious,
- ✓ rational,
- ✓ sweating may be present,
- rectal temperature tends to be lower than in heat stroke.

#### **Treatment of heat stroke:**

- Heat stroke is an emergency which necessitate rapid management.
- Rapid cooling: water spraying (tap water) to replace the absent sweat.
- Monitoring of body temperature.
- Air current by fans to move out the surrounding air saturated by evaporated water to be replaced by fresh air.

## Radiation

- Occupational exposure to radiation occurs due to two main types:
- ✓ Ionizing radiation
- ✓ Non ionizing radiation.

### **Ionizing radiation**

- These are the radiation, which by traversing the air causes ionization to positive and negative ions.
- These include X rays, alpha, beta and gamma radiation. e.g. in medical radiodiagnosis and radiotherapy.

### Health effects:

- Ionizing radiation induces free radicals, which <u>attacks the cell constituents</u>.
- This induces lipid peroxidation of the unsaturated fatty acids of the endoplasmic reticulum and destruction of the DNA of the nucleus.
- The manifestations of acute exposure include:
- skin burns,
- destruction of the mucus membranes causing sever diarrhea,
- sever anemia due to destruction of the bone marrow.

### **Non Ionizing radiation:**

# 1- Infrared:

• Occupational exposure to extremely hot red objects as in iron and steel industry.

## **Health effects:**

• Effects due to heat and posterior polar cataract.

## 2- <u>Ultraviolet</u>:

• Occupational exposure to photocopy machines.

## **Health effects:**

• Conjunctivitis, corneal ulcers and skin erythema.

## **Delayed effects of all radiation include:**

- Cancer: cancer skin-lukemia.
- Varying degrees of anemia.
- Cataract.
- Congenital anomalies.
- Increased rate of abortion.
- Shortening of the life span.
- Sterility.
- Early senility.

## Vibration

• Vibrations are waves of compression and decompression similar to sounds but in a low frequency (less than 40 cps).

## **Occupational exposure:**

- Handing vibrating tools as drills, pneumatic hand screws.
- Exposure occurs also in medical lab on mixing contents of test tubes by using vortex mixtures.
- Hall body vibration occurs among heavy truck and bulldozer drivers.

#### The main health effects of vibration are:

 Vasoconstriction in hands predisposing to Raynaud's phenomenon.

 Osteoarthritis and osteoporosis of hand joins and bones.

#### **Occupational lung diseases**

- These are the group of diseases which can affect either <u>the ventilatory tract</u> (trachea, bronchi and bronchioles) or <u>lung parenchyma</u> (alveoli and pleura).
- Pneumoconiosis are the group of occupational lung diseases which occurs due to inhalation of dust, retention and reaction around such dust.

## <u>Silicosis</u>

- Silicosis is a nodular fibrosis of the lung due to inhalation of respirable dust containing free silica (Silicon dioxide).
- Exposure: Workers in the following industries are exposed to silica dust:
- ✓ Mining.
- ✓ Glass industry.
- Pottery industry.
- ✓ Ceramic industry.
- Sandblasting and mineral polishing.
- ✓ Foundry workers.

### **Pathogenesis:**

- The inhaled dust is engulfed by macrophages.
- Because the silica is cytotoxic, the macrophages rupture and liberate fibroblast attractive substances.
- This initiate fibrosis and formation of fine nodules that may coalesce together to from larger nodules.

• The hilar lymph nodes are enlarged with calcium deposition at the periphery giving the characteristic picture of eggshell calcification in the X Ray.

• Egg shell appearance may also occurs in sarcoidosis and tuberculosis.

### **Diagnosis of silicosis:**

1- Occupational history: working in jobs entailing inhalation of silica dust for a period of 5-10 years.

2-Clinical examination demonstrates symptoms of lung fibrosis e.g. shortness of breath, dyspnea, easily fatigability.....etc. Cough, expectoration may be present in case of concomitant chronic bronchitis. Local chest expectoration is not specific. **3-** X ray of the lung shows <u>nodular</u> <u>opacities</u> of varying size more at the upper parts of the lungs. There may be hilar eggshell calcification.

4- Ventilatory function tests show drop in forced vital capacity.

## **Complications:**

1- Silicosis is a risk factor for TB infection

2- In progressive fibrosis, there may be cor-pulmonale

**3-** Recent studies point to the relation between silica exposure and bronchogenic carcinoma.

## **Prevention:**

Follow the general rules.

**1-Environmental measures are the most important line of prevention:** 

- Substitution of sand by <u>corundum</u> (Al2o3) as an artificial abrasive for sand blasting.
- Wetting the dust during preparation and shaping.

2- Periodic medical examination: by clinical examination and x ray every two years.





## <u>Asbestosis</u>

 Asbestos can induce different diseases in different sites of the body. So it is called now asbestos related diseases.

 Asbestos is imported from Canada, South Africa, Mexico and Brazil

#### **Occupational exposure and uses in Egypt:**

- Asbestos is a unique natural fibrous material with the following advantages:
- Very resistant to friction so used in the manufacture of car brakes and clutch.
- Highly insulating so used in clothes and gloves for oven workers and for insulation of roofs.
- Have a binding capacity so used in asbestos cement industry for manufacture of water pipes, ceiling tiles & roofs and walls.

#### **Pathogenesis:**

- ✓ The fibers are cytotoxic to the macrophages.
- ✓ Rupture of the macrophages, liberates fibrogenic materials which induce the following:
- 1- Diffuse fibrosis of the lung due to exposure to asbestos.
- The fibers may be surrounded by ferritin granules giving the so-called <u>asbestos bodies</u>.
- These are yellow brown in color, beaded and clubbed ended.

- They can be detected microscopically in the sputum of asbestos exposed workers.
- They are indicators of exposure to asbestos but not diagnose asbestosis.
- 2- Interstitial fibrosis especially at the lower half of the lung. The fibrous tissue may pull the diaphragmatic pleura up giving tenting appearance in X-ray.
- **3-** Pleural thickening
- **4-** Pleural plaque: Cartilaginous thickening in the parietal pleura
- **5-** Pleural effusion (rare)

### **Diagnosis of asbestosis:**

**1- Occupational history: history of exposure to asbestos fibers for a period of 5-10 years.** 

2- Clinical examination demonstrates symptoms of lung fibrosis e.g shortness of breath, dyspnea, easily fatigability.. etc. Auscultation may reveal fine crepitations at the base of the lung due to fibrosis.

#### **3-** X ray shows:

### •Diffuse opacities at the base of the lung,

Tenting of the diaphragm,

•Pleural thickening, pleural effusion, pleural plaques.

4- Pulmonary function tests show drop in forced vital capacity.

5- Sputum examination may reveal asbestos bodies.

**\*Other asbestos related diseases cancer larynx, and chronic asthmatic bronchitis.** 

### **Complications:**

- Mesothelioma.
- Bronchogenic carcinoma.
- Cor pulmonale.

-Asthmatic bronchitis is common especially among workers of cement asbestos pipes.

**<u>Prevention:</u>** The same lines of prevention applied with silicosis are applied here with workers exposed to asbestosis.









## **Byssinosis**

 <u>Asthma like manifestation</u> occurs among workers exposed to cotton dust in textile industry during bale opening, carding combing, spinning and sometimes weaving.

• Although cotton industry is wide spread in Egypt, this disease is rare.
#### **Diagnosis:**

- History of exposure to cotton dust to more than 10 years.
- The worker suffers of breathlessness and chest tightness and sometimes cough on the day after a day off.
- Clinical examination: Picture of chronic obstructive airways disease.

- X ray is usually normal except some increase in broncho vascular markings.
- Pulmonary function tests show drop in forced expiratory volume especially at the shift end of the first working day after a holiday.
- **Treatment:** as in asthma or asthmatic bronchitis.
- **Prevention:** Follow general rules.

### Mill fever

 Occurs in new employees unaccustomed to dust although tolerance develops after few days of acclimatization.

• Symptoms: acute onset of fever, chills, cough and general malaise. They start after 5-6 hours from exposure and clear rapidly on removal of patient from the dusty environment.

### Weaver's cough

- Occurs in workers exposed to low grade wet cotton containing molds and fungi.
- It affects all workers, old and new in an epidemic form, after 4-6 hours from exposure.
- Symptoms: Mild dyspnea and persistent irritating cough with yellowish green sputum, aching limbs and back, headache, slight evening temperature and epistaxis in some cases.

#### **Farmer's lung**

 This is a type of extrinsic allergic alveolitis due to antigen antibody reaction at the alveoli due to exposure to <u>spores of the fungi (Micropolyspora faen,</u> Micropolyspora polyspora) found on the moldy hay.

## Bagassosis

 Extrinsic allergic alveolitis due exposure to spores of the fungi thermoactinomyces sacchari found on the stored bagass in the wood and paper industry. The pathological process begins by diseases inflammatory process in the form of granulomatous pneumonitis that occasionally undergoes organization leading to interstitial fibrosis and thickening of the alveolo-capillary membrane.

# **<u>Clinical presentation</u>: it is in the form of acute phase or chronic phase Acute form:**

- Onset: it occurs 4-6 hours after exposure.
- Symptoms: The symptoms are in the form of malaise, fever, chills, pain, unproductive cough, chest tightness and dyspnea.
- These symptoms last from 12 hours up to a week.

# **Signs:** Fever, tachycardia and tachypnea and basal crepitations.

**Investigations:** Serology, pulmonary function tests, and lung biopsy.

<u>Prevention:</u> The most important is the prevention of growth of the fungi on the hay or the bagass by spraying <u>1% propionic</u> <u>acid</u>, otherwise follow the general rules.

# THANK YOU