



Occupational Disease Part-1

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Objectives

- Aware and able to understand the Occupational Diseases
- Understand the disorders and factors related to work

Introduction

- Occupational Diseases
 - These are diseases that occur due to the exposure to hazards at the workplace.
 - “due to causes and conditions attributable to a particular **occupational environment** and not to stimuli encountered outside the workplace”
 - Bernstein et al 1993
 - Long latency period of up to **30 years**

- Work-related diseases
 - Multi-factorial in origin
 - Work may be
 - associated in their causation or
 - may aggravate a pre-existing condition



Topics Covered:

- Occupational Lung Disease
- CNS Disorders
- Liver and Renal Disorders
- Reproductive Disorders
- Musculoskeletal
- Skin
- Noise-induced hearing loss
- Heat Stress
- Sick Building Syndrome
- Cancers

Occupational Lung Diseases

- Occupational Asthma
- Pneumoconiosis
- Organic Penumonitis
- Inhalation Fever
- Infection

Asthma

- Two type of Asthma related to work
 - Occupational Asthma
 - Adult onset asthma
 - Asthma develop after exposure at work
 - Compassable disease
 - Work Aggregated Asthma
 - Childhood or adult onset asthma
 - Asthma symptoms present even before work
 - Asthma make worse due to exposure at work

Occupational Asthma

- Occupational asthma is a disease characterised by
 - Variable air flow limitation and/or
 - Airway hyper-responsiveness
- The symptoms of asthma usually coincide with work and disappear when the patient is away from work.

2 Types of Occupational Asthma

- Sensitiser-induced asthma
 - syndrome of chest tightness, wheezing, shortness of breath, dry cough etc, which appears after a **latent period** of occupational exposure
 - High-molecular-weight agents
 - IgE-mediated (complete allergens)
 - Low-molecular-weight agents
 - IgE-mediated (haptens)

■ Examples

- Animals and plant proteins
 - Laboratory workers, bakers
- Antibiotics, metals
 - Pharmaceutical, metal plating workers
- Acid anhydrides, diisocyanates, plastic acid
 - Epoxy plastics and paints, polyurethane foams and paints, western red cedar products
- Glutaraldehyde (antiseptic)
 - Health care workers

- Without sensitization (Irritant Induced)
 - Occurs without a latent period after substantial exposure to an irritant dust, mist, vapor or fumes
 - Anticholinesterase effect
 - Endotoxin Effects
 - Airway Inflammation
 - Airway Irritation

- Examples
 - Organophosphate pesticides
 - Agricultural workers
 - Cotton dust
 - Textile workers
 - Acids, ammonia, chlorine
 - Paper manufacturing workers
 - Dusts, fumes, mist vapours, cold
 - Construction workers, chemical workers



Reactive Airways Dysfunction Syndrome (RADS)

- Developing without a period of latency and
- Often associated with exposure to high concentrations of irritants.



ACCP Medical Case Definition (American College of Chest Physicians)

Occupational asthma

- Criteria for diagnosis of occupational asthma
 - A. Physician diagnosis of asthma and/or physiological evidence of airways hyper-responsiveness
 - B. Occupational exposure preceded onset of asthmatic symptoms*
 - C. Association between symptoms of asthma and work

- D. Exposure and/or physiological evidence of relation of asthma to workplace environment (Diagnosis of OA requires one or more of D2-D5, likely OA requires only D1)
- 1) Workplace exposure to agent reported to give rise to OA
 - 2) Work-related changes in **FEV1** and/or **PEF**
 - 3) Work-related changes in serial testing for non-specific bronchial responsiveness (e.g., *Methacholine Challenge Test*)
 - 4) Positive specific bronchial challenge test
 - 5) Onset of asthma with a clear association with a symptomatic exposure to an inhaled irritant in the workplace (generally RADS)



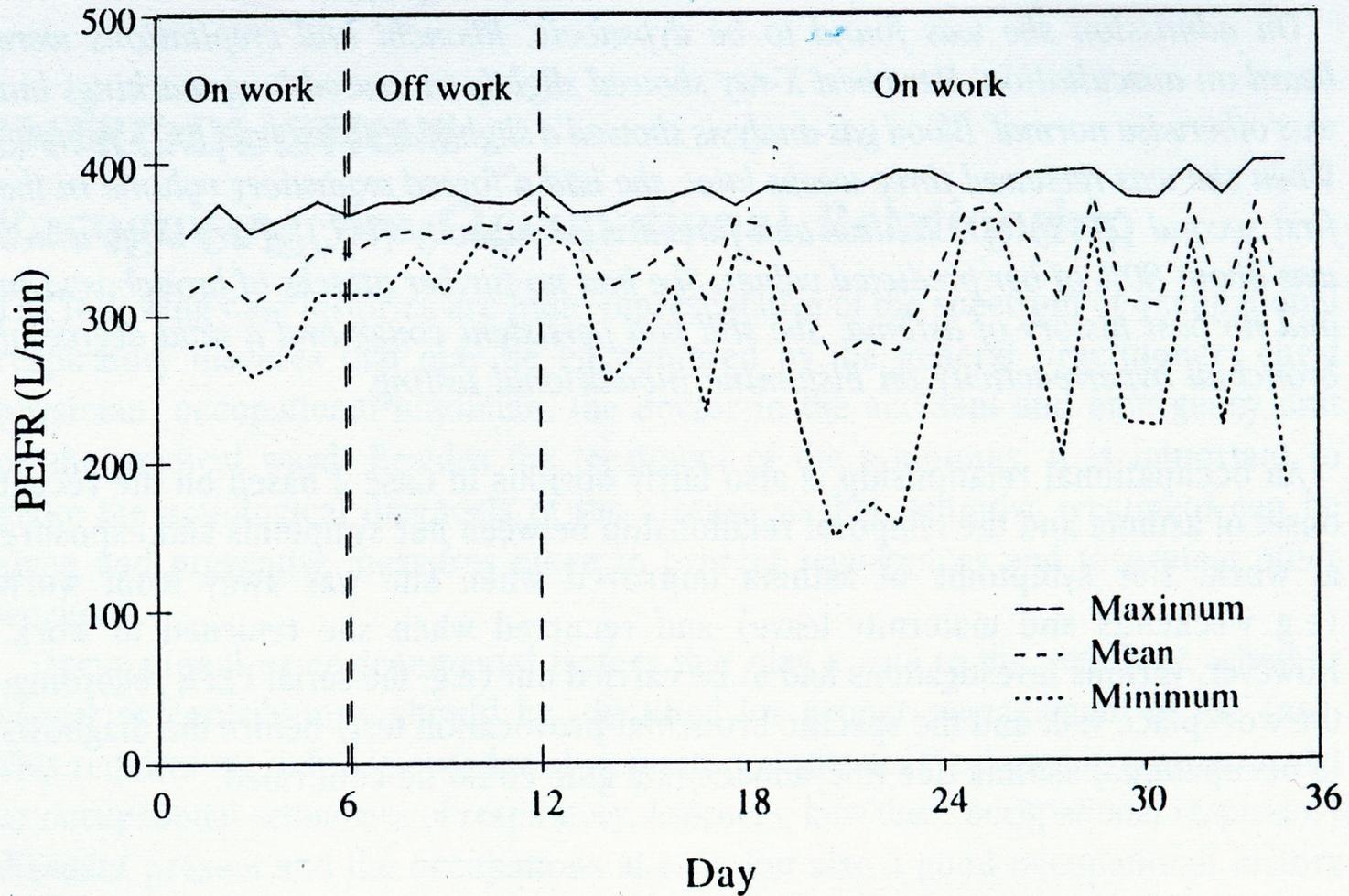
Work Aggravated Asthma (WAA)

- 1) Meets criteria A and C of ACCP Medical Case Definition of OA
- 2) Pre-existing asthma or history of asthmatic symptoms, (with active symptoms during the year prior to start of employment or exposure of interest)
- 3) Clear increase in symptoms or medication requirement, or documentation of work-related changes in **PEFR** or **FEV1** after start of employment or exposure of interest

RADS

(should meet all 7)

- 1) Documented absence of pre-existing asthma-like complaints
- 2) Onset of symptoms after a single exposure incident or accident
- 3) Exposure to a gas, smoke, fume, vapour or dust with irritant properties present in high concentration
- 4) Onset of symptoms within 24 hours after exposure with persistence of symptoms for at least 3 months
- 5) Symptoms consistent with asthma: cough, wheeze, dyspnoea
- 6) Presence of airflow obstruction on pulmonary function tests and/or presence of non-specific bronchial hyper-responsiveness (testing should be done shortly after exposure)
- 7) Other pulmonary diseases ruled out



Serial PEFR

Pneumoconiosis

- A group of conditions resulting from the deposition of mineral dust in lung and the subsequent lung tissue reaction to the dust

Examples

- Asbestosis
- Silicosis

Asbestos

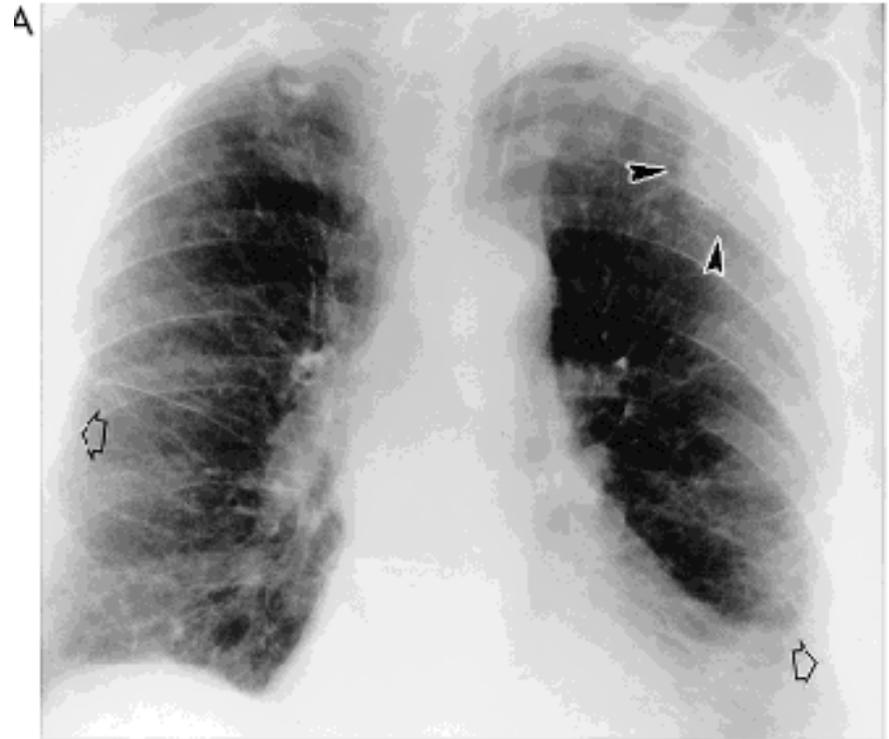
- A generic name given to a fibrous variety of six naturally occurring minerals that have been used for decades in the development of thousands of commercial products.
- Found in
 - insulation and fireproofing materials, automotive brakes and textile products, and cement and wallboard materials.

Asbestosis

- Asbestosis
 - Dyspnoea,
 - Nonproductive cough,
 - Cor pulmonale,
 - Pleuritis pain
- Cancer
 - mesothelioma (esp. *crocidolite*)

CXR : Anteroposterior CXR shows asbestosis involving both lung

- Bilateral pleural thickening (open arrows)
- vaguely defined opacity (arrow head)
- shaggy hearts sign



Mesothelioma

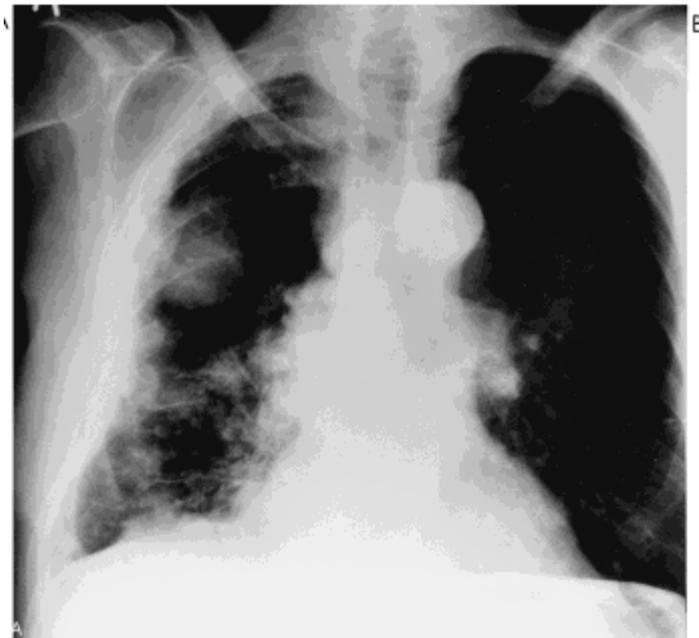
- At least 3500 people in Great Britain die each year from mesothelioma and asbestos related lung cancer as a result of past exposure to asbestos.

Cause

- Arising from pleura/peritoneum
- *crocidolite* exposure
- Latency period:
 - extremely long (up to 30 yrs)
- not related to dose or smoking
- non-occupational/neighbourhood cancer
- S/S:
 - SOB, cough, chest pain, haemoptysis
- Poor prognosis & fatal within months

Mesothelioma

- Large mass at axillary region
- Marked reduction in volume of the right haemothorax with marked irregular nodular thickening of the pleura of the whole right lung



Silicosis

- Inhalation of silica or quartz
- Pneumoconiosis from exposure to silica
- *eggshell calcification* seen on X-rays
pathognomonic
- Other mineral pneumoconiosis may be caused by beryllium, kaolin and mica.

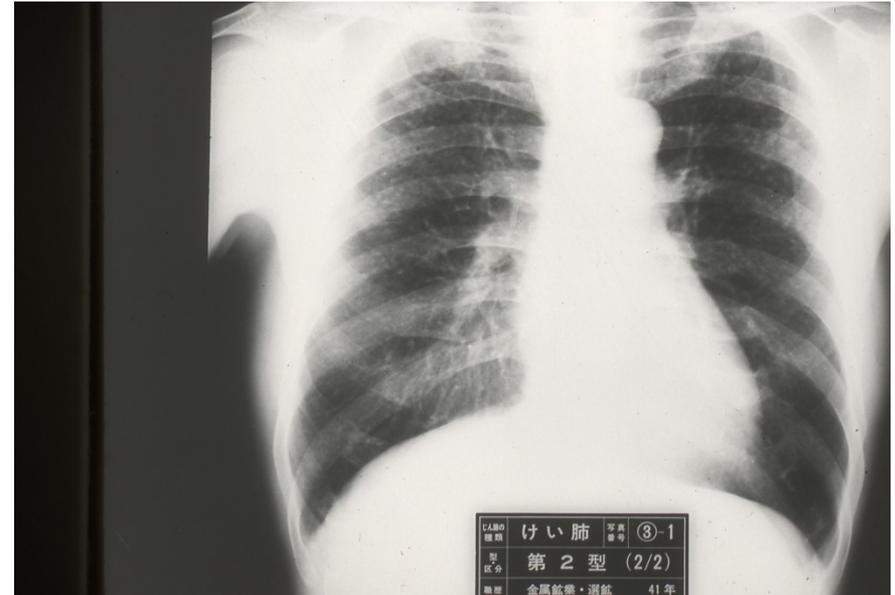
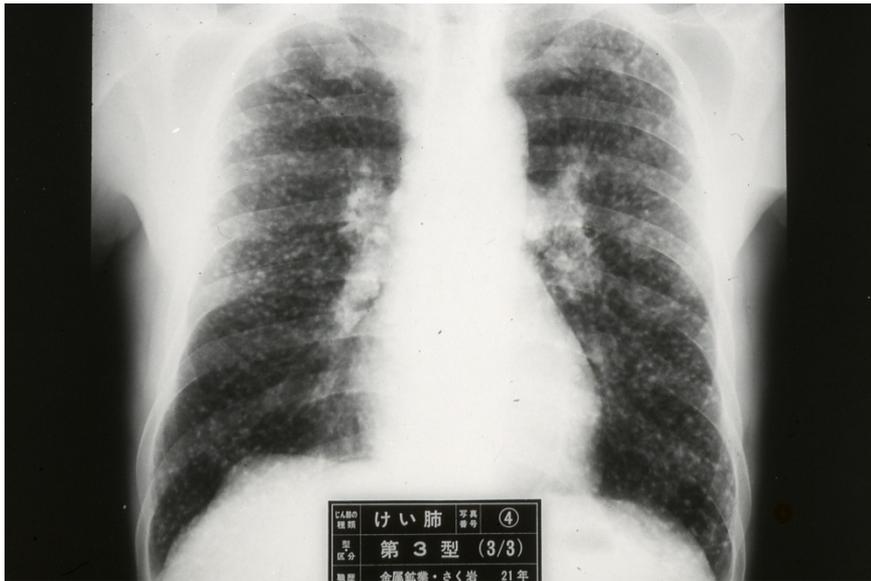
Symptoms

- Exertional dyspnoea
- As a rule, there are no other subjective symptoms
- Cough - a/w bronchitis, smoking, environmental factors
- 3 chief complication :
 - pulmonary TB,
 - respiratory insufficiency and
 - acute pulmonary infection.

Radiographic findings

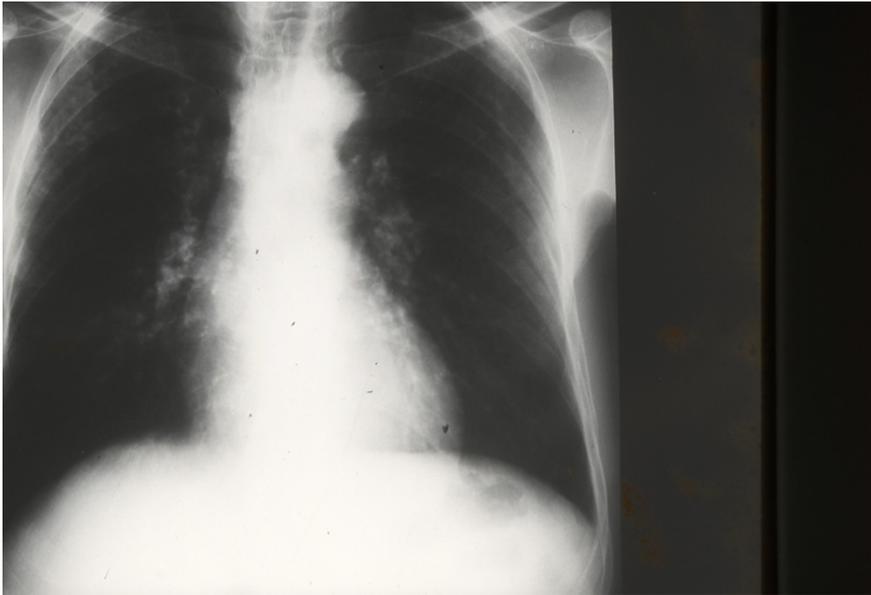
- Small rounded opacities, predominantly in the upper zones
- Hilar lymphadenopathy
- Egg shell calcification
- Progressive Massive Fibrosis - large opacities (> 1 cm)
- Emphysema
- Cavitation - ? PTB

Silicosis





Eggshell calcification



Diagnosis of silicosis

- History of silica exposure
- Chest radiograph - consistent with silicosis
- Absent other illnesses that mimic silicosis
- May need histologic examination

Progressive Massive Fibrosis

- Symptoms
 - chronic cough to SOB
- Signs
 - cor pulmonale and respiratory failure
- CXR
 - nodules > 1cm on a background of small rounded opacities
- LFT
 - lung volume and diffusing capacity (restrictive type)
 - marked restriction on spirometry or lung volume measurement
 - reduced carbon monoxide diffusing capacity
 - reduced arterial oxygen tension at rest or with exercise

Accelerated Silicosis

- Identical to classic silicosis except shorter duration in CXR changes and respiratory impairment
- Appear after more intense exposures of shorter (5 to 10 years) duration
- Deterioration in lung function is more rapid,

Organic Pneumonitis

- Extrinsic allergic alveolitis
- Hypersensitivity pneumonitis
- Granulomatous pneumonitis



- An immunologically-mediated inflammatory disease of the lung parenchyma that is induced by inhalation of organic dusts that contain a variety of etiological agents

■ Bacteria

- *Faenia rectivirgula* (moldy hay)
 - Farmer's Lung
- *Thermoactinomyces sacchari* (moldy sugar cane fiber)
 - Bagassosis

■ Fungi

- *Aspergillus clavatus* (moldy malt)
 - Malt worker's lung
- *Pencillium casei* (moldy cheese)
 - Cheese worker's lung

- Amoebae
 - Naegleria gruberi, Acanthamoeba castellani (Contaminated water)
 - Humidifier lung
- Animals proteins
 - Avian proteins (bird droppings, feathers)
 - Bird breeder's lung
 - Rodent proteins (urine, sera, pelts)
 - Animal handler's lung

Inhalation Fevers

- Short term but debilitating flu-like syndrome after exposure to
 - organic dusts,
 - Organic Dust Toxic Syndrome
 - polymer fumes, and
 - metal fumes

- Metals
 - Zinc
 - Copper
 - Manganese
- Teflon pyrolysis products
 - Polytetrafluethylene

- Symptoms includes
 - Fever
 - Chills
 - Myalgia
 - Headache
 - Malaise
 - Cough
 - Chest discomfort
- Treatment
 - Symptomatic treatment



CNS Disorders

Neurologic & Psychiatric

- Wide range of chemicals
 - Pesticides
 - Halogenated hydrocarbon
 - Metals
 - Solvents



Clinical Features (1)

- Peripheral neuropathy
 - weakness,
 - foot-drop,
 - wrist drop;
 - sensory loss,
 - paraesthesia

Clinical Features (2)

- Neuromuscular blockage
 - sensory and
 - motor loss
- Psychiatric manifestations
 - psychosis,
 - mood changes,
 - behavioral changes,
 - suicidal tendency

Clinical Features (3)

- Encephalopathy
 - impaired visual acuity / visual fields
 - myoclonus and other movement disorders, paraplegia
 - memory impairment
 - ataxia
 - Parkinson's syndrome
 - seizures

Environmental Exposures

- Minamata (1950's)
 - Mercury in fish and shellfish
- “Yusho” (1968)
 - Cooking oil contaminated with polychlorinated dibenzofurans (PCDF), polychlorinated biphenyl (PCB)
- Seveso (1976)
 - Dioxin discharged from over-heated reactor

Neurobehavioral Disorders

- Indoor air pollution / sick building syndrome
 - non-specific symptoms: headache, mild mood disturbance, lethargy, irritability, forgetfulness
 - skin, eye and nasal irritation, cough, dyspnoea, dizziness
 - contaminants present at low level
- Multiple chemical sensitivity syndrome
 - controversial; recurrent, non-specific symptoms involving many organs in response to low levels of exposure to many different chemicals

Pesticides

- Organophosphorus
 - malathion, parathion
 - inhibitors of cholinesterase
 - overstimulation of parasympathetics
- Organochlorine
 - chlordane, lindane, kepone
 - hexachlorophene
 - neurotoxicity in newborn infants
 - seizures, tremors

Halogenated Hydrocarbons

- Polychlorinated biphenyls (PCB)
 - very stable compound used in hydraulic fluids, lubricating fluids, heat exchangers, plasticizers
 - also carcinogenic
- Dioxins
 - 2,3,7,8-tetrachloro-dibenzo-p-dioxin (TCDD)
 - unwanted compounds formed in manufacture of chlorophenyls and 2,4,5-T

Metals

- **Leads**
 - organic form (tetra-ethyl lead)
 - encephalopathy in children, neuropathy in adult
 - seizures, delirium, coma; motor weakness
- **Mercury**
 - inorganic Hg: tremor, ataxia, personality changes, emotional lability, nervousness
 - organic Hg: paresthesia of extremities, visual field constriction, ataxia, dysarthria, deafness
- **Arsenic**
 - peripheral neuropathy usually symmetrical involving both motor and sensory components

Organic Solvents

- Peripheral neuropathy
 - Sensory loss in extremities (n-hexane)
 - 5th nerve involvement (trichloroethylene)
 - Loss of vibration/position sense (acrylamide)
 - Motor loss at later stage
- Encephalopathy
 - Euphoria, excitement, confusion, dizziness, headache, motor incoordination, bizarre behaviour, intellectual decline

Electromagnetic Fields

- Low levels of electromagnetic fields associated with brain cancer and leukemia in electrical workers, children near to power transmission lines,
- use of mobile phones
 - still controversial



Liver Disorders



Vulnerability of liver to toxicants

- It receives a large proportion of the venous return
- First organ perfused by nutrients and toxicants absorbed in the GIT
- It removes and metabolizes almost all blood transported substances
- Primary organ for the biotransformation of the chemicals

Infection

- Schistosomiasis
 - chronic hepatitis
- Hydatid cyst of the liver
 - sheep raising communities
- Weil's disease
 - miners; workers in rice field; fishmonger
- Hep B and Hep C
 - health care personnel)
 - cirrhosis & malignant hepatoma

Chemicals

- Arsine gas
 - excessive RBC destruction → haemolytic jaundice
- Carbon tetrachloride
 - Direct hepatotoxicity
 - (liver damage is indicated by excess urobilinogen in the urine, raised serum aminotransaminase; and impaired BSP clearance).
 - In severe cases; resembles acute infective hepatitis
 - CCl₄ is widely used in dry cleaning; as a constituent in fire extinguishers and as industrial solvent

- Halogenated hydrocarbon
 - Used in solvents, in polishes, dyes & explosive
 - aliphatic: methyl chloride, tetrachloroethane, chloroform
 - aromatic: nitrobenzenes, dinitrophenol, trinitrotoluene
- **Yellow phosphorus:**
 - highly poisonous.
 - Ingestion gives rise to jaundice and may have fatal termination.
- **Arsenic, antimony, ferrous iron compound –**
 - liver damage

Chemicals

- Vinyl chloride
 - exposure
 - polymerization of polyvinyl chloride;
 - cleaning of reaction vessel.
 - Health effects:
 - hepatic fibrosis (non-cirrhotic type),
 - splenomegaly & portal HPT and **hepatic angiosarcoma** (1st case 1974).
 - TLV was bring down from 500 ppm to 5 ppm.

- Alcohol
 - cellular damage
 - chronic hepatitis
 - cirrhosis.
- Barbiturate
 - potent inducer of liver microsomal enzymes
 - PCM, anti TB, halothane (hepatic necrosis); steroid (damaging biliary duct-cholestatic jaundice)



Renal Disorder

Renal Disease Associated with Toxins

- Acute renal failure
- Pigment nephropathy
- Interstitial nephritis
- Glomerulonephritis
- Nephrotic syndrome
- Cancer

Nephrotoxic agents

- Heavy metal
 - Cadmium (ouch-ouch disease or itai-itai byo), lead, mercury, arsenic, chromium
- Organic solvent
 - CCl₄ and chloroform
- Agents causing obstructive uropathies
 - methotrexate, sulfonamide, ethylene glycols
- Agents producing pigment
 - induced nephropathies - arsine gas, heroin