Occupational cancers

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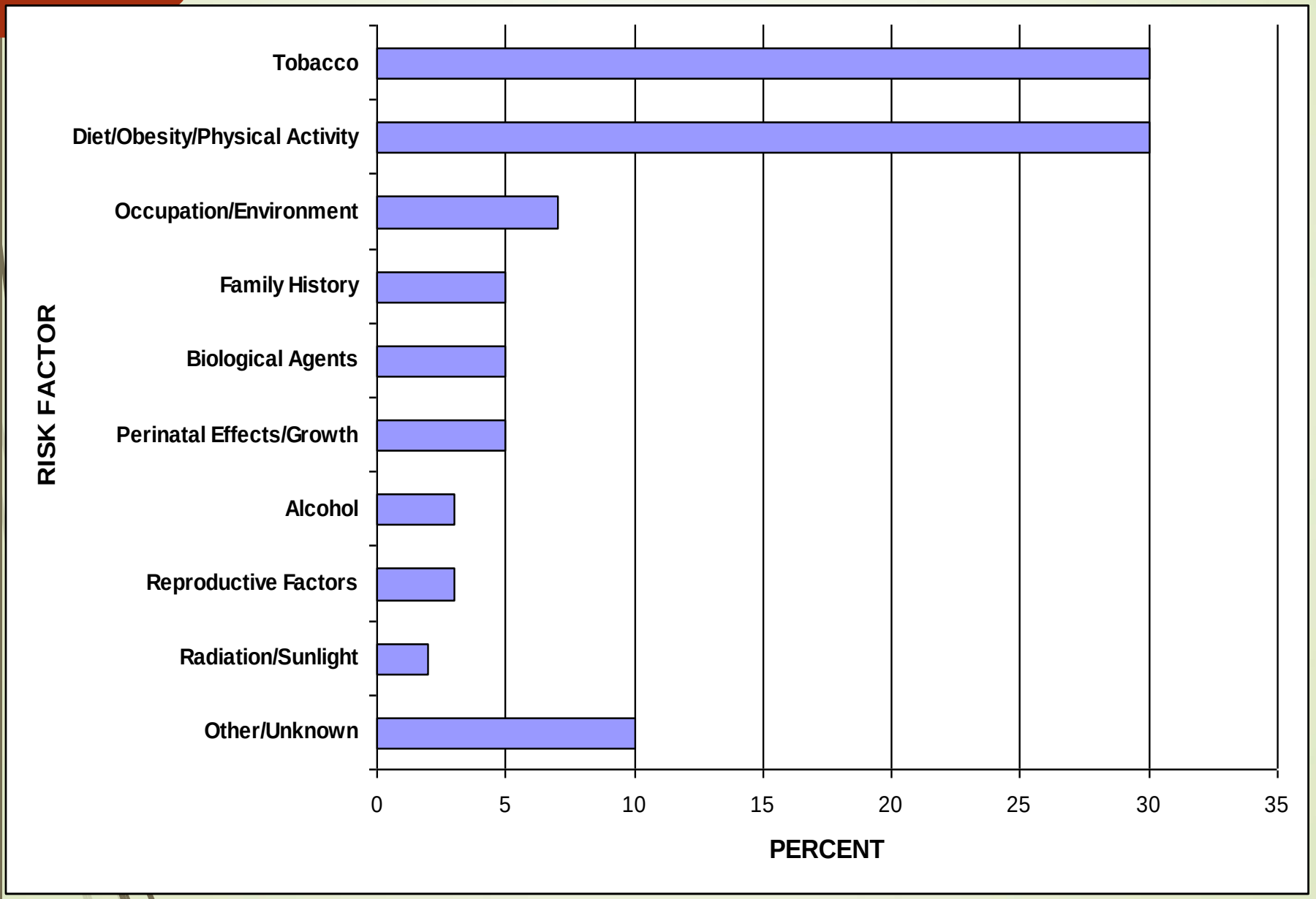
What is Occupational Cancer?

- Occupational cancer is cancer caused by exposure to carcinogens in the workplace.
- Approximately **5-10%** of all human cancers.
- Most occupational cancers are preventable.

What causes cancer?



Carcinogens

- ***A carcinogen is an agent which is responsible for causing cancer.***

- **Chemical carcinogens**
- **Physical carcinogens**
- **Biological carcinogens**

Is there a safe level for exposure to carcinogens?

- The carcinogen directly affects,there is no safe level of exposure
- **A safe level of exposure is difficult to define.**
- Uncertainty about safe levels of exposure to carcinogens has resulted in the principle of keeping exposure.

"as low as reasonable achievable "

Can you prevent cancer by reducing a person's exposure to a carcinogen?

- In general the higher the exposure a person has to a carcinogen, the more chance they have of developing cancer.

- Anything that can be done to reduce a person's exposure to a carcinogen will reduce their chances of developing cancer

Does smoking cause cancer in the workplace?

- As well as being a significant cause of cancer in its own right, smoking has been shown to have a synergistic effect with some other carcinogens.

- Asbestos and smoking (multiplative)
- These substances include:

  radon, arsenic, aromatic amines and

  crystalline silica.

History

- **1775:** Scrotal cancer ; chimney sweeps
- **1895:** Bladder cancer; aromatic amines
- **1934:** Lung cancer; asbestos
- **1962:** Lung cancer(S.C.C); chloromethylethers
- **1974:** Liver angiosarcoma; vinyl chloride

CARCINOGENESIS

- **Stages in tumor development :**

  - ***Initiation***
  - ***Promotion***
  - ***Progression***
  - ***Metastasis***

CARCINOGENESIS

- **Induction –latency period**

  3-5 to 40 or more years (12-25 y)

- **Thresholds**

- **Dose-response relationships**

Distinction between initiators & promoters

Initiators

- *Genotoxic*
- *Carcinogenic alone*
- *Irreversible reaction*
- *Threshold dose*
- *Single exposure may be sufficient to induce cancer*

Promoters

- *Epigenic*
- *Not Carcinogenic alone*
- *Reversible effect*
- *Threshold probably exist*
- *repeated exposures required*

Agencies

- IARC: International Agency for Research on Cancer
- ACGIH: American Conference of Governmental Industrial Hygienists
- NTP: US Public Health Service National Toxicology Program
- NIOSH: National Institute for Occupational Safety and Health

IARC

- Group 1 – carcinogenic to humans
- Group 2
  - 2A – probably carcinogenic to humans
  - 2B – possibly carcinogenic to humans
- Group 3 – not classifiable
- Group 4 – probably not carcinogenic to humans

GROUP 1 (IARC) CLASSIFICATION

Arsenic	Lung, Skin, Liver
Asbestos	Pleura & peritoneum, Lung, Larynx, GI
Benzene	Leukemia
Beryllium	Lung
Cadmium	Lung
Chromium	Lung
Coal tar	Skin, Scrotum, Lung
Mustard gas	Lung
Nickel	Lung, Nasal sinus
radiation	Skin
Vinyl chloride	Liver

Industrial process	Agent	Cancer Type
Aluminum production	PAH	Lung,bladder
Shoe manufacture	Benzene	Leukemia
Iron & steel founding	PAH,Silica	lung
Rubber industry	Aromatic amines solvents	Bladder, leukemia

LUNG CANCER

LUNG CANCER

- 30% of all cancer deaths
- The most preventable risk factor:

  cigarette smoking(All histologic types)
- There is no one cell type that is pathognomonic of an occupationally related lung cancer
- 75-90% are symptomatic at diagnosis
- Anorexia, weight loss, and asthenia in 55-9096.
- New or changed cough in up to 60%.
- Hemoptysis in 5-3096.
- Pain, often from bony metastases, in 25-40%.
- Symptoms and signs and laboratory and imaging procedure findings do not differ from lung cancers of nono ccupational etiology

Causes of lung cancer

- Arsenic
- Asbestos
- Beryllium
- Cadmium
- Chloromethyl ethers
- Acid mists
- PAHs
- Mustard gas
- Nickel
- Radon
- Chromium
- Cobalt

Asbestos

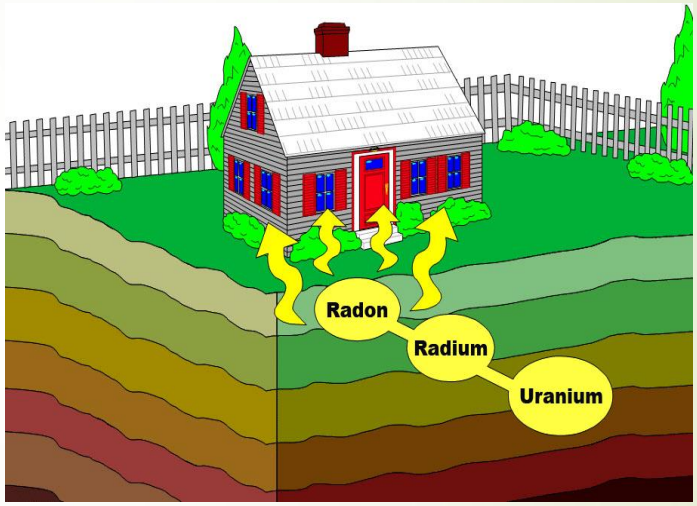
Asbestos

- Lung cancer is a major asbestos-related disease

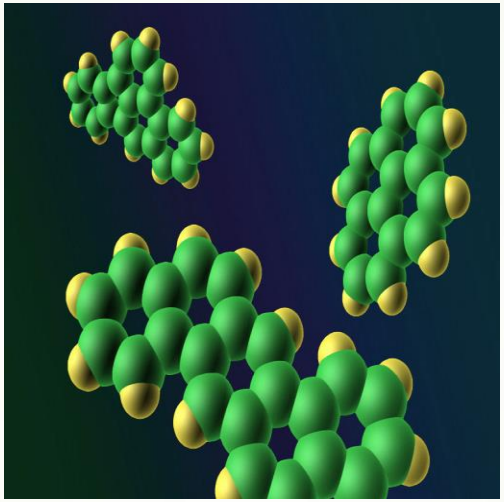
- 20% of all deaths in asbestos-exposed
- 7% of all lung cancer

- A latency period: 20 years
- Asbestos: initiator
- Cigarette smoke: promoter
- Adenocarcinoma

Radon



Polycyclic Aromatic Hydrocarbons



Coke oven workers, roofers, printers, Rubber plant , asphalt production

MESOTHELIOMA

Asbestos

- Asbestos miners
- Construction workers
- Workers exposed to insulation materials in production, installation, and removal
- Shipyard workers
- Asbestos textile manufacturing
- Welders, plumbers, electricians

MESOTHELIOMA

- The latency period: 30 years or more
- smoking dose not increase the risk
- Persistent chest pain ,dyspnea, dry cough, weight loss
- Pleural effusion, pleura thickening or nodularity interstitial pulmonary fibrosis, pleural plaques, pleural calcification

MESOTHELIOMA

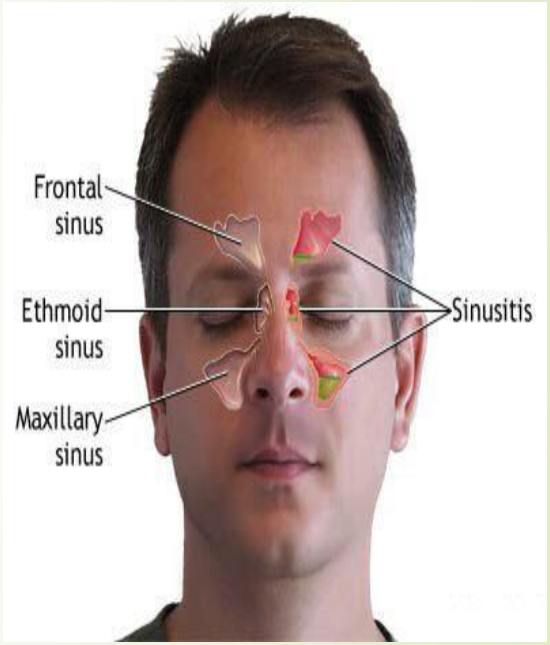
- Treatment:
  - Surgical
  - Radiotherapy
  - Chemotherapy
- Prognosis:
  - 75% of patients die within 1 year after diagnosis

survival is longer for:

- Patients whose tumors are in the pleura
- epithelial types
- younger than 65 years,
- those who respond well to chemotherapy,
- those able to undergo surgical resection.

NASAL CAVITY & SINUSES CANCER

- **Wood and other dusts**
  (Boot and shoe manufacturing ,Furniture workers, Carpenters and joiners Textile manufacturing)
- **Chromium**
- **Nickel**
- **Isopropyl alcohol**
- **Formaldehyde**
  (furniture and textile finishing, garment industry , Embalming)
- **Mustard gas**
- **Cutting oils** (mineral oils)



WOOD AND OTHER ORGANIC DUSTS

Furniture manufacturing

Textile manufacturing

Boot and Shoe manufacturing

- Rare
- Men > women (2:1)
- Usually squamous cell histology (50%), Adenocarcinomas (10%)
- very uncommon <50 years of age, increase with age
- Cigarette smoking also increases the risk of nose and paranasal sinus cancer

- **Symptoms :**
  - **Unilateral nasal obstruction**
  - **Non-healing ulcer**
  - **Occasional bleeding**

  - **The earliest symptoms : low-grade chronic infection, with discharge,obstruction ,and minor intermittent bleeding**

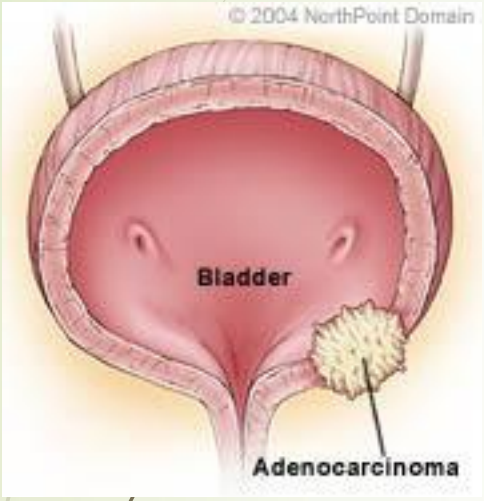
Laryngeal CANCER

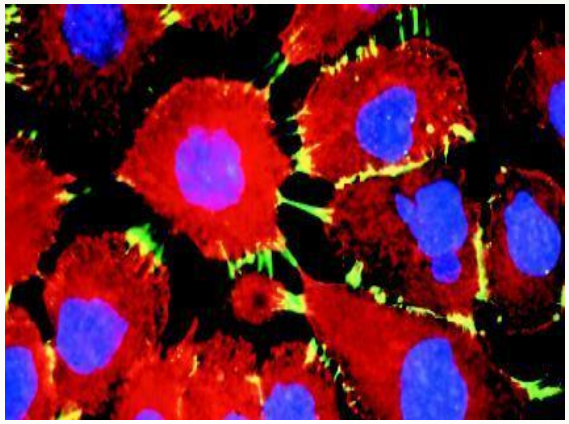
- Asbestos
- Strong inorganic acid mists
- Rubber production
- Mustard gas
- Cigarette smoking and alcohol use are the major nonoccupational risk factors.

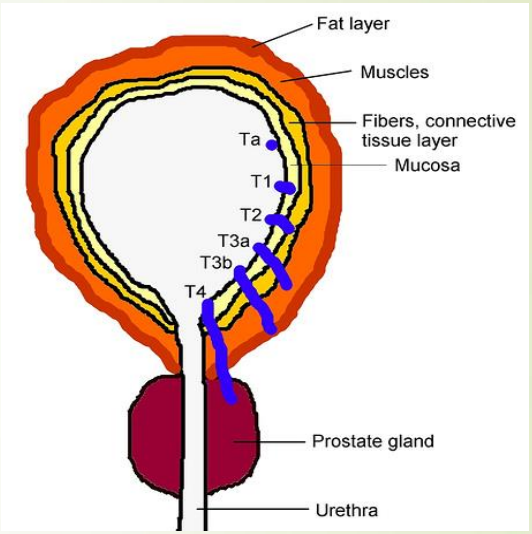
- Hoarseness is an early presenting symptom
- Much more frequent in men than in women (4.5:1)
- Usually middle aged or older
- Usually squamous cell histology

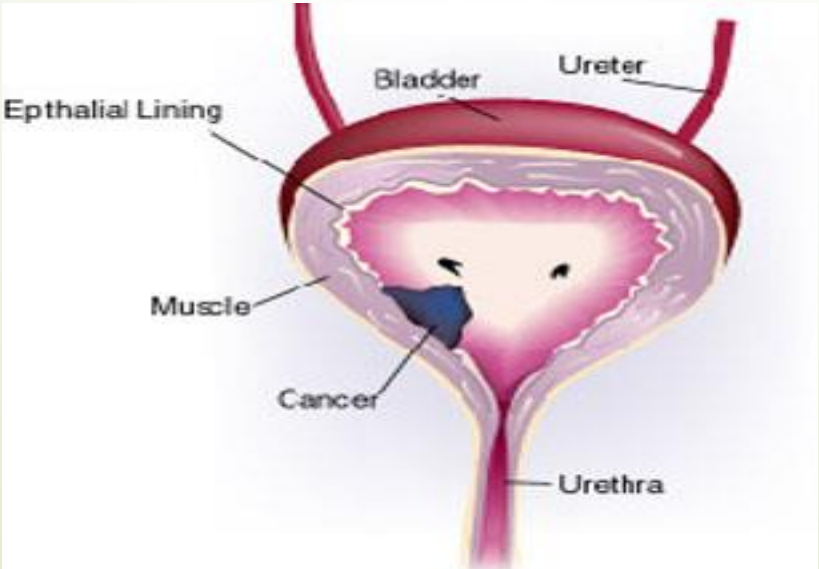
- **At the time of diagnosis:**
  - 60% localized
  - 30% regional spread
  - 10% distance metastases
- 40% supra-glottic, 59% glottic, 1% sub-glottic

BLADDER CANCER

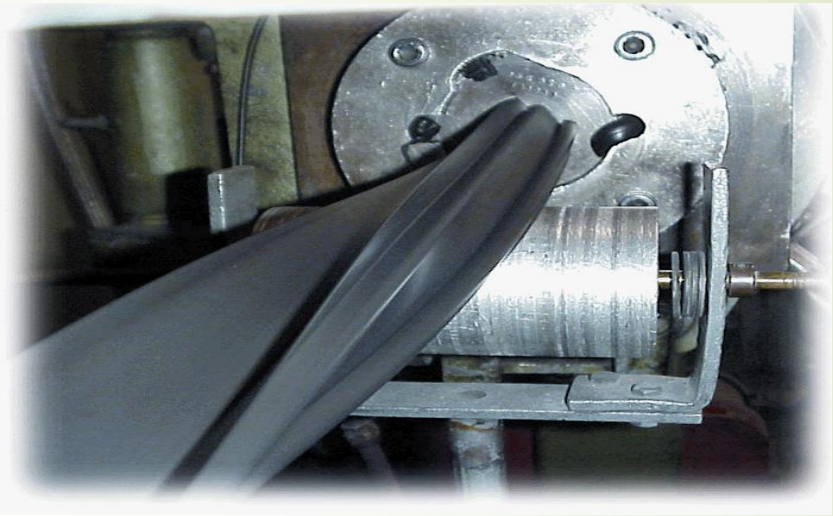


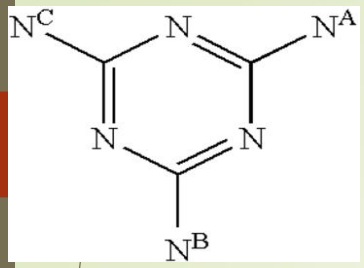




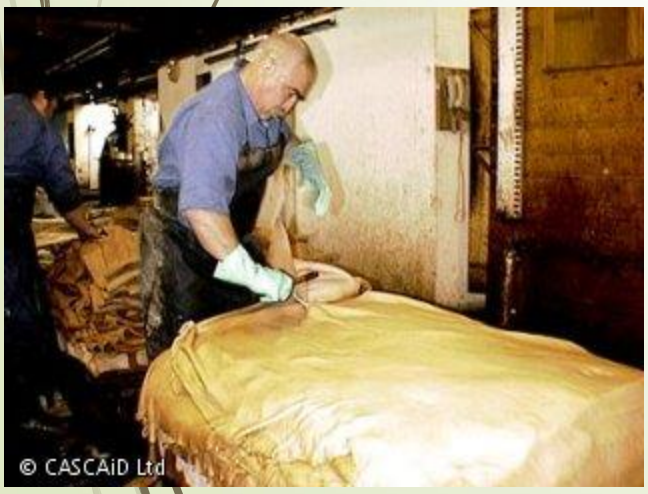


4- Aminobiphenyl





Chlornaphazine

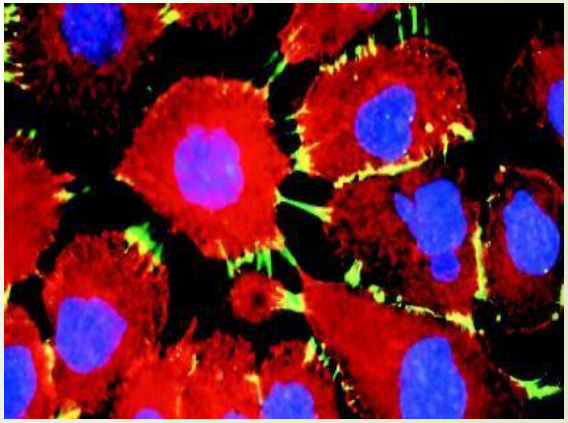


Benzidine

Naphtylamine

Pathogenesis & Pathology

- Most occupation-related urinary tract tumors caused by contact of the bladder epithelium with carcinogens in the urine.
- Because of the concentrating ability of the kidney, the bladder is exposed to higher concentration.
- Urothelial tumors:
  - 90% transitional cell type
  - 6-8 % squamous cell
  - 2% adenocarcinoma



BLADDER CANCER

- 2-6 % of all malignant tumors
- M/F = 2/1
- Cigarette smoking is the most important etiologic factor

- latency period: 20 years
- Presenting complaints of hematuria (in 80-90% of patients and usually is painless and gross)
- vesical irritability(20% of patients with increased frequency, dysuria, and urgency.)

- Diagnosis :
  - urine cytologic examination
  - cystoscopy
  - transurethral biopsy

Screening

- **Urinary cytologic examination:**
  - **Screening tool**
  - **Sensitivity (75%), specifity (99.9%)**
  - **The used to screen only certain occupations at risk**
  - **The screening of high-risk patients may result in a significant reduction of the stage of disease at diagnose, with improved long-term survival**

Skin Cancer

- **Solar (UV) radiation**

  Outdoor workers

- **PAH**

  -Workers exposed to coal-tar, coal-tar pitch and soot , asphalt creosotes, anthracenes, paraffin waxes , and lubricating and cutting oils **such as roofers**

  -Workers exposed to untreated or mildly treated mineral oils, for example, **metal workers**

- Workers exposed to **shale oil** and those in the **petroleum refining industry**

- **Arsenic**

  Arsenical pesticide production and use

  Copper, lead, zinc smelting

- **Ionizing radiation**

  Uranium miners

  Health workers

SKIN CANCER

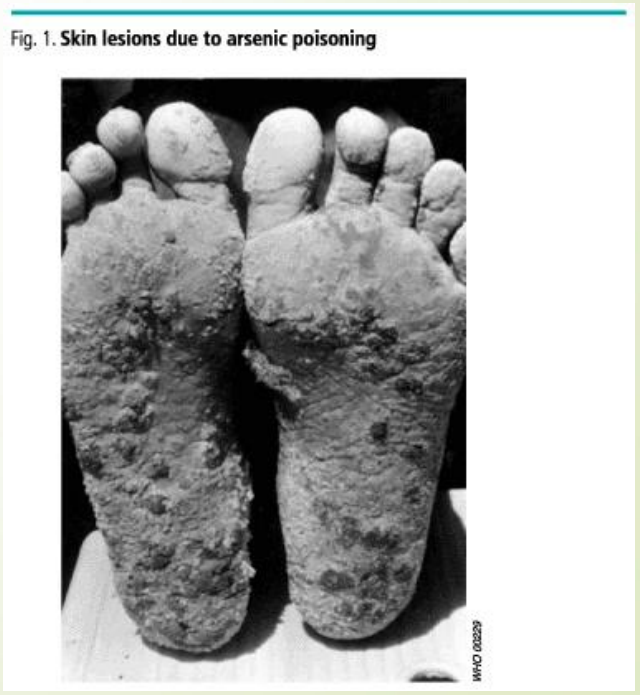
- **The histologic types of skin lesions associated with sun exposure:**

  Solar keratosis, keratoacanthomas, BCC, SCC, and malignant melanomas

  - 13% of all solar keratosis develop into SCC but these are rarely aggressive

SKIN CANCER

- Arsenic:
  - Punctate keratoses of the palms and soles and hyperpigmentation are frequently seen
- Cancers tend to be multiple and occur in younger patients than those attributable to UV light.



PAH

- Latent periods between exposure to PAHs and skin cancer vary from about 20 (coal tar) to 50 years or more (mineral oil)
- Photosensitization develops initially, with recurring erythema and intense burning of the exposed skin.
- After repeated episodes, poikilodermatous changes appear, especially on the exposed skin of the face, neck, and hands.
- Keratotic papillomas (tar warts) which later may become squamous cell carcinomas, basal cell carcinomas, and keratoacanthomas

Ionizing radiation

- The latent period for radiation-induced skin cancers varies inversely with the dose, with the overall range from 7 weeks to 56 years (average 25-30 years),
- Occur in areas with chronic radiation dermatitis
  - Heavy exposure
  - Predominantly SCC
  - The hands and feet and occasionally on the face

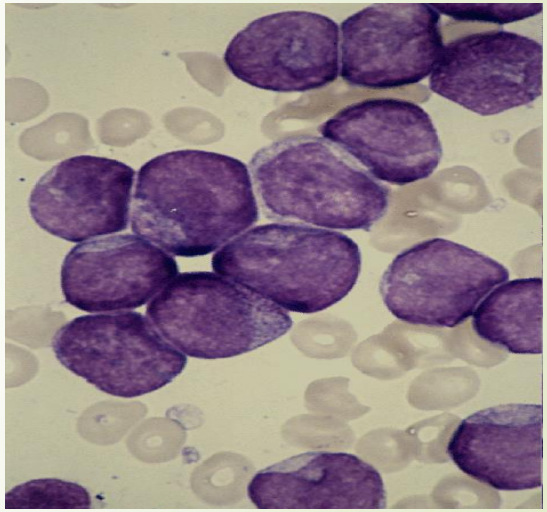
- The maximum allowable dose equivalent of ionizing radiation for occupational exposure to the skin is 30 rems in any year
- Except that forearms and hands are allowed

  75 rems in any year (because there is little red marrow

  in the forearms and hands).

Hematologic Cancers

- Ionizing radiation
- Benzene
- Ethylene oxide
- Cytotoxic drugs



Liver cancer

- Hepatocellular carcinoma
  - Hepatitis B&C, alcohol, aflatoxins
  - Solvents associated with hepatic fibrosis (trichloroethylene in metal degreasing operations
- Hepatic Angiosarcoma
  - Vinyl chloride
  - Thorotrast
  - Arsenic
    - Vintners
    - Arsenical pesticide production and use
    - Copper, lead, zinc smelting

Angiosarcoma

- Middle-aged men
- with a male-to-female ratio of 4:1.
- The mean age at presentation is 53 years.
- Characteristic features of the disease include:

  - long period of asymptomatic laboratory abnormalities,

  -difficulty in diagnosis, and poor response to treatment

Screening Tests

- OSHA standard for vinyl chloride:

  periodic testing, including **history** and **physical examination** and **liver function tests**

  ultrasound, liver scan, angiography, and biopsy should be performed as indicated for significant abnormalities.

BILE-DUCT CANCER

- Dichloropropoane(propylene dichloride)
- Dichloromethane (methylene chloride)
  - chemical intermediates (propylene,
  -carbon tetrachloride, and tetrachloroethylene)
  - textile stain removers
  - oil and paraffin extractants
  - metal cleaners
  - solvents
  - paint- and stain-removers
  - grain and soil fumigant
- Nonoccupational risk factors are primary sclerosing cholangitis, chronic ulcerative colitis

- Often asymptomatic in early stages
- Symptoms in advanced stages include jaundice, pruritus, dark urine, light-colored stools, right upper quadrant abdominal pain
- Diagnosis by imaging and endoscopic, laparoscopic, or open abdominal biopsy

KIDNEY CANCER

- Trichloroethene
- Ethylene trichloride
- Arsenic, cadmium, (group 2A)
- Printing processes, (group 2A)
- Welding fumes(group 2A)
- Major non occupational risk factors:
  - smoking
  - obesity

- Hematuria,
- Unilateral low back or flank pain,
- Fatigue,
- Unexplained weight loss
- Blood tests can show acute or chronic renal insufficiency and anemia.
- Urinalysis can demonstrate hematuria and proteinuria
- Urine cytology may be positive for dysplastic cells.

- Workers with significant histories of exposure to TCE may benefit from medical surveillance,
- Periodic physical examinations, urinalysis, and blood work monitoring hemoglobin and kidney function

OVARIAN CANCER

- **Asbestos is the major occupational risk factor (group 1)**
- **Ionizing radiation**
- **Major non-occupational risk factors include :**

  - genetic predisposition

  - increased number of lifetime ovulations,

  - increased body mass index

- Often asymptomatic in early stages.
- Nonspecific symptoms such as pelvic or abdominal pain,
- Abdominal bloating,
- Vaginal bleeding,
- Dysuria,
- Early satiety

THE END