Occupational Lung Disease: The Pneumoconioses

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Glossary;
BeLPT; Beryllium lymphocyte proliferation test
IARC; International Agency for Research on Cancer
OEL; Occupational Exposure Limit
RPE; respiratory protective equipment
TWA; time weighted average

The pneumoconioses
Chronic lung disease caused by long term exposure to respirable particles (typically <5um) of mineral dusts

Epidemiology
- Generally long latent period between exposure and development of disease
- Risk of disease is proportional to degree of exposure
- Incidence in general reducing worldwide due to substitution and improved mining control measures in developing world
- *Clinical Pearl;* notable increase in silicosis in Western world countries due to manufacture of quartz kitchen tops

Importance of focused occupational/environmental history

Spotlight on Silicosis; a pneumoconiosis resulting from exposure to respirable crystalline silica primarily from quartz
Recent increase in incidence of accelerated silicosis associated with the manufacture of quartz kitchen counter tops in setting of poor workplace control measures

Pathophysiology*;* see Fig. 2
Inhalation> phagocytosis>lysosomal damage> NALP3 inflammasome activation>fibrosis

Clinical Features:
Acute: following heavy intense exposure with onset of dyspnoea and dry cough within months; progression over 1-2 years to respiratory failure
- Massive exposure can cause acute secondary alveolar proteinosis

Subacute; gradual onset dyspnoea, dry cough over years following moderate exposure
Chronic; Slow development over many years following low level exposure
CXr; upper, mid-zone fibrosis +/- classical 'egg-shell' calcification (Fig.1) of hilar lymph nodes
Coalescence of nodules can lead to progressive massive fibrosis (PMF)
Spirometry maybe normal (early stage disease), restrictive or obstructive

Associations:
Tuberculosis; linked to impaired macrophage phagocytosis
Bronchogenic carcinoma; IARC Class 1 carcinogen
- Smoking synergy noted

Autoimmune disease;
- Scleroderma (Erasmus Syndrome)
- Rheumatoid arthritis (Caplan's syndrome)

Chronic kidney disease

Fig. 1

Pneumoconioses; Investigations
Radiology;
- CXr; distribution of fibrosis may indicate causative agent (E.g. asbestosis – lower zones; CWP – upper zones)
- HRCT; more sensitive in detecting interstitial fibrosis and progression from simple disease to PMF in silicosis/CWP

Spirometry; usually restrictive pattern but maybe obstructive/mixed
- Reduced DLCO most sensitive pulmonary function change

Tests to consider;
- Bronchoscopy/BAL/biopsy (note generally insufficient tissue to diagnose CWP/silicosis)
- BAL necessary to dx berylliosis; required for BeLPT
- Open lung biopsy (rarely required; limit to suspected cancer dx)

Differential Diagnoses;
IPF; Sarcoidosis; RA; Scleroderma; SLE; Drug/Radiation Fibrosis; COPD

Pneumoconioses examples – causative agents
Coal worker's pneumoconiosis (CWP) – coal dust
Asbestosis – asbestos fibres
Silicosis – quartz (crystalline silica)
Kaolin pneumoconiosis – kaolin (*China clay)*
Stannosis – tin ore
Berylliosis – beryllium
Siderosis – iron oxide
Baritosis – barium sulphate
Bauxite worker's lung - aluminium

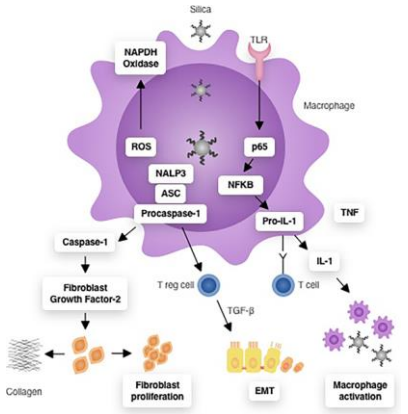

Fig. 2

Fig. 3

Prognosis
Variable depending on cause
- Range from benign (stannosis; siderosis), variable (CWP) to aggressive (asbestosis) course

Management
- Little in the way of effective direct treatments
- Removal from further exposure essential
- Supportive care
- Ensure appropriate vaccination, advise smoking cessation
- TB screening in silicosis
- Role for lavage in silicosis associated acute secondary alveolar proteinosis
- Role for steroids in acute berylliosis

Cornerstone is prevention
- Cases indicate inadequate control measures and need for review of existing workplace control measures
- Note OEL; just 0.1mg 8hour-TWA i.e. exposure must be limited < 0.1mg inhaled dose per working day (see Fig. 3)
- As always PPE/RPE is the least effective control measure and appropriate worker education, engineering and administrative controls necessary (Fig. 4)

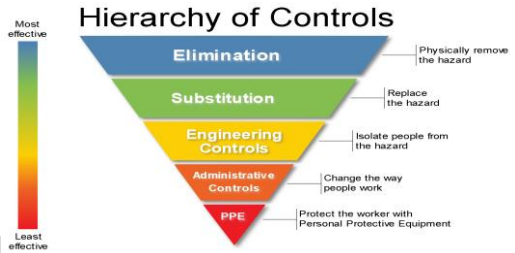

Fig. 4