Asbestos-related disease

C Bolton, A Richards, P Ebden

Until the 1980s, asbestos was widely used throughout the UK. The incidence of asbestos-related disease is still climbing because of the long delay in developing the disease from the initial exposure. The spectrum of diseases encompasses malignant mesothelioma, asbestosis, asbestos-related lung carcinoma and benign pleural disease, including pleural plaques.

Dr C Bolton is Specialist Registrar in Respiratory and General Medicine in the Department of Medicine, **Dr A Richards** is Consultant Radiologist in the Department of Radiology, **Dr P Ebden** is Consultant Respiratory Physician and Senior Lecturer in the Department of Medicine, Prince Philip Hospital, Dafen, Llanelli SA14 8QF

Correspondence to: Dr C Bolton

The properties of asbestos as an electrical and thermal insulator allowed use throughout the world. However, with this has come the tremendous burden of related disease. Asbestos-related disease has a lag of up to 30–40 years following exposure and encompasses a range of disease from lung cancer and malignant pleural mesothelioma to benign asbestos pleural plaques, pleural thickening and asbestosis. Patients not only present with clinical symptoms but also with the concern of potentially developing disease. They often know of work colleagues who have died or suffered from an asbestos-related cause. It will become increasingly important for both the hospital doctor and general practitioner to be aware of the spectrum of disease, to appreciate its significance to the exposed population and to subsequently investigate and manage appropriately. This requires a careful and detailed occupational history to be taken.

EPIDEMIOLOGY

Asbestos is a generic term for several naturally occurring fibrous mineral silicates (*Figure 1*). The fibres are divided into those that are flexible and curly (serpentine) and those that are needle shaped (amphiboles). Within the serpentine group is chrysolite (white asbestos), which accounts for 95% of world asbestos production (Landrigan, 1998). The amphiboles consist of crocodilite (blue) and amosite (brown), tremolite, anthophyllite and actinolite.

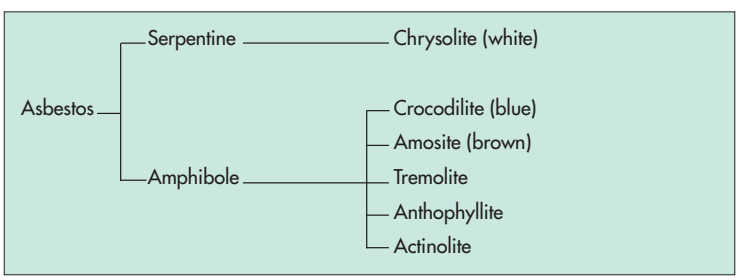


Figure 1. Types of asbestos.

Suspicions of the risk of asbestos to humans began in the early 1900s, and subsequent studies in asbestos mills proceeded (Merewether and Price, 1930). However, it was Doll (1955) who suggested an increased incidence of lung cancer in patients with asbestosis.

The definition of asbestos is 'unquenchable' (Sykes, 1982) – it was this property that allowed its widespread use as an inexpensive thermal, electrical and sound insulation. This put people in a considerable number of occupations at risk (*Table 1*). Their wives, who were responsible for washing the dusty asbestos-covered clothes, are also at risk (known as 'fowling the nest'), as well as individuals living in close proximity to an asbestos works.

Production and consumption peaked in the mid-1970s, and although this has now reduced in Europe and North America, globally there is still a considerable amount produced.

ASBESTOS-RELATED DISEASES

The range of asbestos-related diseases include pulmonary fibrosis (asbestosis), benign pleural disease and malignancies, such as bronchial carcinoma and mesothelioma.

TABLE 1. Occupations with risk of asbestos exposure

Electricians
Insulation workers/laggers
Carpenters
Boilermakers
Ship building
Power station workers
Plumbers and pipefitters
Railway workers
Construction and demolition workers

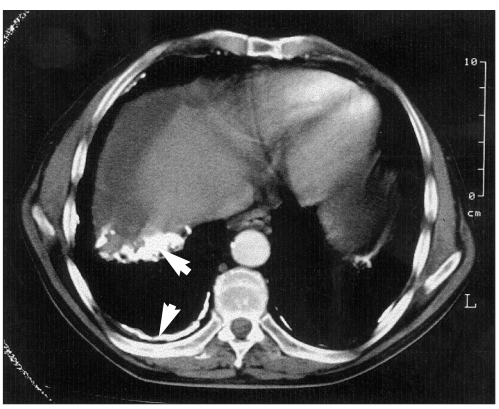
Benign pleural disease

Pleural plaques: Pleural plaques are smooth, discrete elevations on the parietal pleura occurring on the chest wall (often beneath the ribs), frequently affecting the diaphragm but avoiding the costophrenic sulci. One margin is usually indistinct, as it smooths off into normal pleura. Plaques are strongly associated with asbestos exposure and may occur after only a low level of exposure. The route by which asbestos fibres reach the parietal pleura is not known for certain, but it is likely that the fibres pass through the visceral pleura and are carried in the pulmonary lymphatic system.

The plaques are hyalinized, avascular fibrous tissue, usually covered by normal mesothelial cells and often calcified (*Figure 2*). They take at least 10 years to form. They rarely cause lung function impairment unless they are extensive and encase the lung when they can cause restricted lung function. The plaques may be present even if the chest X-ray appears normal. Computed tomography (CT) shows them much more clearly. While asbestos pleural plaques are not considered to be pre-malignant, as they are a marker of significant asbestos exposure, the incidence of malignancy in these patients is higher (Rudd, 1996).

Acute pleurisy and pleural effusion: This condition may pass asymptomatically or cause acute shortness of breath, fever and pleuritic pain. The effusion can be unilateral or bilateral and usually develops within 10 years of exposure. On aspiration, pleural effusions are usually exudates, polymorphic, can be haemorrhagic and have a volume of less than 500 ml. The pleural biopsy shows non-specific inflammation and fibrosis. Rarely is any treatment other than analgesia required. Occasionally, pleural aspiration is required to ease breathlessness. The effusions tend to resolve within 6 months but can return years later and are thought to cause rounded atelectasis or diffuse pleural thickening.

Figure 2. Computed tomography scan appearance of calcified pleural plaques (arrowheads).



Rounded atelectasis: The theory behind the formation of rounded atelectasis is that the pleural effusion invaginates the lung parenchyma and causes fibrotic adhesions. They are juxtapleural and typically in the lower lobes. A pathognomic feature is the distortion of the vessels and bronchi in the vicinity of the lesion – the 'comet tail' can be seen very well on CT scanning (*Figure 3*). There is an indistinct margin towards the hilum and the rounded atelectasis contrasts well.

Diffuse pleural thickening: Diffuse pleural thickening can occur after a single exposure and affects the parietal and visceral pleura, especially in the lower thorax, and does not spare the costophrenic angles. It is usually bilateral and extends over more than four rib interspaces. Mediastinal pleural thickening should raise concern of malignancy. Diffuse pleural thickening can produce progressive breathlessness and restrictive lung volumes on pulmonary function testing. The transfer factor is low, but when corrected for lung volume, the transfer coefficient is high, as the quality of the lungs is preserved.

Asbestosis

This is a diffuse, symmetrical interstitial fibrosis caused by asbestos, not a generic term encompassing other asbestos-related diseases. Requiring a heavy exposure to develop, it takes up to 15–20 years to develop from first exposure. The fibrosis is most marked in the lower lobes and spreads out from the respiratory bronchioles and alveolar ducts. Asbestos bodies (fibres coated with ferritin) are usually seen. Progressive disease leads to honeycombing and mediastinal lymphadenopathy.

The flexible nature of the serpentine fibres increases the likelihood of being phagocytosed by the macrophage and mucociliary system. The subsequent asbestos-induced free radical formation is associated with the onset of DNA damage, signalling mechanisms, gene expression, mutagenicity and apoptosis via the release of

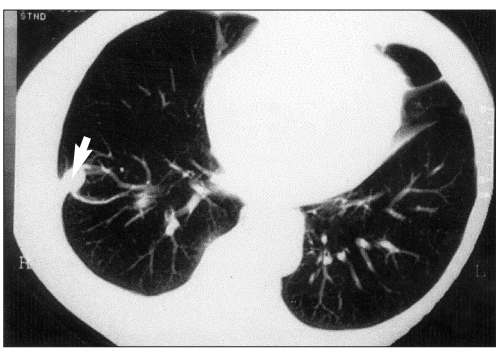


Figure 3. Computed tomography scan appearance of rounded atelectasis (arrowhead).

cytokines, oxidants and growth factors (Newman and Gottschall, 1999).

The patient presents with progressive breathlessness, cough and sometimes weight loss. Forty per cent of patients have finger clubbing. Examination reveals fine late-inspiratory crepitations, especially at the lung bases.

The chest X-ray is neither sensitive nor specific for asbestos-induced fibrosis – it may be normal. High resolution CT is much more helpful. The pulmonary function tests show a restrictive picture with gas transfer impairment even when corrected for volume. Bronchoalveolar lavage, and occasionally sputum, shows asbestos bodies. Histology is unnecessary to confirm the diagnosis unless exposure is not evident.

Few patients respond to drug therapy such as steroids. Further treatment is supportive, such as the influenza vaccine and oxygen if required.

Malignant mesothelioma

This is a rare pleural, and occasionally peritoneal, tumour which is usually caused by asbestos. The forecasted number of males dying from mesothelioma each year in Western Europe is expected to double over the next 20 years. This will amount to 250 000 deaths over the next 35 years (Peto et al, 1999). The other putative causes are radiation exposure and the Simian virus 40. Amphiboles are more potent carcinogens than serpentine. There is a long latency from first exposure of around 30 years. The risk is increased depending on exposure length, concentration of fibres and fibre type but can occur after a low exposure. Smoking is not a contributory factor in the development of mesothelioma.

It starts as a local mass and spreads diffusely to encompass the lung and invade adjacent structures. There are a variety of histological presentations, i.e. epithelial, mesenchymal (fibrous or sarcomatous) or mixed. Asbestos bodies are not seen. Lymphatic and haematogenous metastases are usually late manifestations that are generally clinically silent.

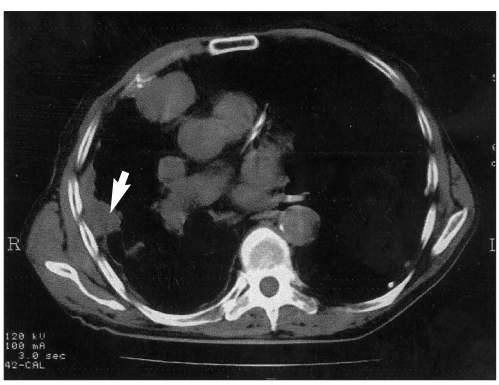


Figure 4. Computed tomography scan appearance of malignant mesothelioma (arrowhead).

Presentation can be with unilateral chest pain (in 69%), occasionally pleuritic, progressing to a constant dull ache; breathlessness (59%); fever, sweats, weakness and fatigue (33%). Also noticed are weight loss and cough (Adams et al, 1986). Rarely does finger clubbing occur. On examination, there may be signs of a pleural effusion or of a fixed contracted hemithorax.

Chest X-ray may show the pleural effusion or lobulated pleural thickening. Other pleural plaques may be seen. CT shows the abnormality more accurately together with the extent (*Figure 4*).

Pleural aspiration usually shows a haemorrhagic fluid that is an exudate. In large tumours, the glucose concentration and acidity of the fluid are low. Cytological examination may show malignant mesothelial cells together with varying numbers of lymphocytes and polymorphonuclear leucocytes (Adams et al, 1986). Cytology shows a diagnosis in one third of patients, although cytological distinction between benign and malignant mesothelioma can be difficult. Results are improved by pleural biopsy (and more so by an ultrasound- or CT-guided biopsy). Thoracoscopy allows a diagnosis in 80–90%. Although diagnosis is ideal, repeated needle insertions should be minimized, as the tumour can seed along the puncture tracts.

There are no randomized, controlled trials to establish the role of surgery, but research continues in this area. Many chemotherapeutic agents have been tried in mesothelioma, but none have consistently produced a response rate above 20%. A UK trial using triple therapy is proceeding under the review of the British Thoracic Society and the Medical Research Council. Immunotherapy (interferon and interleukin-2) and gene therapy (e.g. genes for cytokines and immune recognition via a range of delivery systems) are being investigated (Upham et al, 1995).

The prognosis remains extremely poor – median survival is 12–18 months. The mainstay of treatment is symptomatic relief. Prophylactic radiotherapy is given to biopsy sites to prevent seeding of the tumour along the tract. It can also be useful for localized pain. Pleural aspiration with subsequent pleuradhesis is recommended to relieve breathlessness. Optimal analgesia should be given and nerve blocks should be considered.

The incidence of peritoneal mesothelioma has been steadily increasing over the years. The ratio of pleural to peritoneal disease is 12:1 (British Thoracic Society Standards of Care Committee, 2001). The diaphragm undersurface is almost always involved, but the tumour rarely penetrates into the thoracic cavity. The prognosis here is much worse. Sources such as the palliative care and Macmillan services offer support and advice.

Lung cancer

Asbestos exposure increases the risk of all types of lung cancer. All fibres appear to exert the same effect on risk. There is a synergistic action between asbestos exposure and smoking. It is felt that smoking may delay the clearance of asbestos fibres and increase penetration of the fibres into the walls of the airways (Morgan and Seaton, 1995). The risk of lung cancer appears to be linearly related to the cumulative asbestos exposure. There is not enough evidence to show that only those with asbestosis develop lung cancer.

Other diseases

There may be an increased predisposition to carcinoma of the oesophagus, stomach, colon, larynx and also to a variety of lymphoid malignancies if exposed to asbestos.

COMPENSATION AND ASSISTANCE

There are a variety of sources from which to seek compensation for asbestos-related disease. The diseases that are compensatable are:

- Diffuse pleural thickening
- Asbestosis
- Lung cancer associated with asbestosis or diffuse pleural thickening
- Mesothelioma.

The Benefits Agency offers benefits to a patient suffering from one of the above disorders if it is agreed that the patient inhaled asbestos during paid employment. The government may offer a one-off payment under the Pneumoconiosis, etc (Workers' Compensation) Act 1979 for the above illnesses, as long as the patient has claimed for industrial injury disablement. The value of the compensation depends on the level of disability from which the patient is deemed to suffer.

The patient can also seek common law compensation directly from their previous employer. Even employers that are now out of existence can be brought to court if their insurer is known. Compensation is claimed for pain, suffering, inconvenience and disability. Loss of wages or earning capacity can be claimed together with the cost for a carer, medical expenses or special equipment. For such court action, it is imperative that the patient seeks help from a solicitor who is knowledgeable in this area.

If a patient dies and the doctor feels that asbestos may have helped cause death, the death should be reported to the coroner, even if the actual cause of death was known, e.g. pneumonia. The next of kin can claim within 6 months of death on behalf of the beneficiaries.

The Occupational and Environmental Disease Association is a charity offering help to patients and their family with asbestos-related disease. It is a political channel, advisory centre and offers facilities for tissue analysis.

CONCLUSION

The effect of asbestos on the exposed population has been and will continue to be a major health challenge. There is a wide spectrum of disease associated with asbestos, inflicting pain and breathlessness on the patient as well as being associated with cancer. With the long lag in time from exposure to presentation of the disease, an increasing number of patients will be affected and present for assistance. Therefore, it is important to be aware of the differences in presentations and their implications for the patients' care. HM

Conflict of interest: none.

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KEY POINTS

- Many people have been exposed to asbestos in their lifetime, and a detailed history should be sought.
- The time lag from exposure to disease can be 30–40 years, and some asbestos-related disease can occur after minimal exposure.
- There is a range of disease related to asbestos exposure, including bronchial carcinoma, malignant mesothelioma, asbestosis and benign pleural disease.
- Computed tomography and pulmonary function tests produce more detailed information on asbestos-related disease than a chest X-ray alone. A patient may have disease with a normal chest X-ray.
- The forecasted number of males dying from mesothelioma each year in Western Europe is expected to double over the next 20 years.
- The prognosis for mesothelioma remains poor, but research is proceeding into potential multi-chemotherapy regimens as well as gene therapy and the role of surgery.
- The diagnosis of some asbestos-related diseases may allow compensation from the Benefits Agency or via the patient's employer. The patient should be made aware of this on diagnosis.