**131I macro-aggregated albumin perfusion scanning and chest radiography in asbestos exposure**

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**Summary**

131I macro-aggregated albumin perfusion scanning and conventional radiography were used to study the lungs of 108 men who had been exposed to asbestos dust. The presence or absence of basal crackles was recorded in all cases. Forced vital capacity (FVC) was measured in 94 cases. Underperfusion of the lower zones of the lungs was considered to be present in only 8 of 39 cases with small irregular opacities classified as category 1/0 or higher on the 1971 International Labour Organization classification for pneumoconiosis. In 5 of 69 cases classified in categories less than 1/0, perfusion in the lower zones appeared to be impaired. Details of these cases are given. Underperfusion was more common among men with basal crackles or reduced FVC (<80% of predicted value) but this trend was not statistically significant.

Crystal et al. have reported that a scintigram might show reduced perfusion in areas of lung affected by idiopathic interstitial fibrosis. This finding has been reported in cases of interstitial fibrosis caused by asbestos. Secker-Walker and Ho concluded that perfusion scans could be used to estimate the proportion of pulmonary dysfunction due to asbestos exposure even when emphysema was also present. Abou El-Hage et al. suggested that perfusion scans could be used to estimate disability.

For some years we have carried out perfusion scanning of asbestos workers with and without parenchymal changes on conventional radiographs. A summary of this experience and our conclusions are presented.

**Subjects and methods**

Studies of 108 men exposed to asbestos dust in mines or factories were performed using both 131I macro-aggregated albumin (MAA) pulmonary perfusion scanning and chest radiography on the same day. The exposure periods ranged from a few months to over 30 years, and the times since first exposure were between 4 years and over 30 years. The men were selected solely because they happened to attend the bureau on a day when 131I MAA was available. Only one or two people were subjected to scanning daily because it is most unusual for more than two miners who have been exposed to asbestos to attend on any particular day. All the men scanned were considered in the analysis. The scans were performed with each man’s consent after explanation of the procedure. Between 200 and 300 µCi 131I MAA was used, depending on body mass. Prone (anterior) and supine (posterior) lung scans were obtained using a Siemens Scinimat 2 rectilinear scanner with undercouch detector. No lateral scans were done.

The chest radiographs were postero-anterior views at 60 - 80 kilovolt-peaks (kVP) or 125 kVP with Bucky diaphragms used in all cases, and 200 kVP radiographs as well as left and right anterior oblique views were obtained in most cases. All radiographs were assessed by 3 observers simultaneously and their consensus determined the category of parenchymal small irregular opacities according to the 1971 International Labour Organization (ILO) classification of radiographs of pneumoconiosis.

The lung scans were examined by the same three observers. Underperfusion was subjectively assessed and classified simply as absent, definite or marked (Fig. 1). Perfusion in the upper third of the lung field was assessed, but any defect here was not ascribed to asbestosis since it was believed to be more probably caused by emphysema.

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For some years we have carried out perfusion scanning of asbestos workers with and without parenchymal changes on conventional radiographs. A summary of this experience and our conclusions are presented.

**Results**

Of the 108 men studied, change was found in 69 on conventional radiography. Of these, 39 had irregular opacities of category 1/0.
2. This patient was aged 63 years and had spent 25 years in asbestos mining; it was 30 years since first exposure. He was an ex-smoker and complained of dyspnoea. Basal crackles and rhonchi were heard. There were massive pleural plaques, calcified and uncalcified, especially on the left. His radiograph was classified as category 0/1, i.e. a suspicion of irregular opacities had been aroused but, after consideration, dismissed. The patient showed clinical and physiological evidence of obstructive airways disease (forced expiratory volume in the 1st second (FEV1)/FVC 55%). There was bilateral perfusion loss in the lung bases, which was marked on the left. In fact, perfusion loss affected most of the left lung possibly because of the marked pleural lesions there. The apices showed no significant loss. The evidence of obstructive airways disease makes one cautious in interpreting the basal perfusion defect; however, in view of his exposure to asbestos and the presence of crackles this loss might well have supported the diagnosis of parenchymal asbestosis.

Case 2. This patient was aged 65 years and had spent 25 years in asbestos mining; it was 28 years since first exposure. He was a pipe smoker and asymptomatic. There was pleural calcification and also possible uncalcified plaques in the axillary regions of the lungs on oblique radiographs. He also had silicosis. There was no suspicion of irregular opacities (category 0/0). Basal crackles were heard. Lung function tests indicated a degree of obstructive airways disease (forced expiratory volume in 1st second (FEV1)/FVC 51%). There was bilateral perfusion loss in the lung bases, which was marked on the left. In fact, perfusion loss affected most of the left lung possibly because of the marked pleural lesions there. The apices showed no significant loss. The evidence of obstructive airways disease makes one cautious in interpreting the basal perfusion defect; however, in view of his exposure to asbestos and the presence of crackles this loss might well have supported the diagnosis of parenchymal asbestosis.

Case 3. This patient was aged 61 years and had spent 19 years in asbestos mining; it was 30 years since first exposure. He was a pipe smoker and asymptomatic. There was pleural calcification and also possible uncalcified plaques in the axillary regions of the lungs on oblique radiographs. He also had silicosis. There was no suspicion of irregular opacities (category 0/0). Basal crackles were heard. Lung function tests indicated a degree of obstructive airways disease, i.e. airway resistance was 4.2 cm H2O/l/s as measured in the body plethysmograph and his FEV1/FVC was 51%. On the perfusion scan, loss was definitely present in the upper thirds of the lung fields. Basal perfusion loss was marked, especially on the left side. The loss of perfusion in the upper thirds of the lungs might have been due to emphysema and silicosis. It cannot be excluded that the marked basal perfusion loss was due to causes other than asbestosis, although this is unlikely.

Case 4. This patient was aged 68 years and had spent 6 months in asbestos mining 30 years before. He had never smoked and complained of slight dyspnoea. No basal crackles were heard. There was pleural calcification and his radiographs were read as category 0/1. Lung function was normal. The perfusion scan showed marked underperfusion at the lung bases which, in the absence of other possible causes, was attributed to asbestosis.

Case 5. This patient was aged 68 years and had spent 6 months in asbestos mining 30 years before. He had never smoked and complained of slight dyspnoea. No basal crackles were heard. There was pleural calcification and his radiographs were read as category 0/1. Lung function was normal. The perfusion scan showed marked underperfusion, which was attributed to asbestosis.

Case 6. This patient was aged 38 years and had spent 10 years in asbestos mining, and it was 10 years since first exposure. He smoked and complained of slight dyspnoea. There were no crackles. Conventional radiographs were read as category 0/1. There were no plaques. His FEV1/FVC was 65% but other lung function tests were normal. He showed definite perfusion loss in the upper thirds of the lung fields but marked loss at the bases.

Table 1 shows the relationship between the presence of basal crackles and loss of FVC (< 80% of predicted) and basal perfusion defect on scintigraphy. When crackles or FVC loss was present twice as many men showed a perfusion defect than if these signs were absent. However, the differences were not significant.

![Table 1. Relationship between basal crackles, loss of FVC and basal perfusion defect](image)

### Discussion

There have been few reports on the value of perfusion scintigraphy of the lungs for the early diagnosis and quantitative assessment of asbestosis. Sulotto et al. studied 20 cases of asbestosis with 131I MAA perfusion scans and reported areas of decreased radioactivity in all cases, but the correlation between the severity of radiographic changes and the scintigraphic defects was poor.

Seaton studied 133Xe ventilation and perfusion scans in patients with pulmonary parenchymal asbestosis and some with isolated pleural change. In those with parenchymal change there was greater persistence of the injected radioactive material after wash-out than in normal controls. There was no abnormality in those with isolated pleural change.

In our study, 20.5% of cases showing parenchymal small opacities on conventional radiographs were considered to have an abnormality in the lower lung field on the perfusion scan. Underperfusion defects were more common in men with crackles or with reduced FVC but the finding was not statistically significant — possibly due to small numbers (Table 1).

Five case histories have been recorded because the perfusion scans showed significant basal underperfusion while the radiographs were classified as 0/1 or 0/0, i.e. could not be read as showing definite irregular opacities. Pathological studies have proved that radiographs may appear normal despite the presence of moderate interstitial pulmonary fibrosis due to asbestosis.

Furthermore, Crystal et al., using 99mTc in cases of idiopathic pulmonary fibrosis, found impaired perfusion in areas of lung which appeared radiologically normal. It is therefore considered possible that our 5 subjects had asbestosis, although this cannot be proved without a lung biopsy specimen (this was not obtained in any of these subjects). It may be noted that in 4 of the 5 cases the radiographs were classified as category 0/1, i.e. the appearance had aroused a suspicion of irregular opacities, and that all except 1 (case 5) presented with pleural changes consistent with the effects of asbestosis.

We conclude that 131I MAA perfusion scanning is of limited value in the investigation of workers exposed to asbestosis. Correlation with radiographs is poor and radionuclide perfusion scans help little in the assessment of disability. Very occasionally, however, a perfusion scan may be of value in people who have
Fan-assisted hot-air ovens as sterilizers in doctors’ surgeries

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Summary

A novel method of sterilization for use in doctors’ rooms is described. Inexpensive domestic hot-air ovens that are easy to handle and require little maintenance attain temperatures more than adequate to kill bacteria, viruses and spores.

Materials and methods

The initial evaluation was carried out using a Rowenta Visotherm KA30, a model of oven considered to be convenient in operation and accident-proof. It is 34 x 24 x 26 cm and durably constructed of metal; inside are two removable wire-type shelves. The top or dome is made of transparent, thick, ovenproof glass and an insulated handle lifts it up on hinges. This movement automatically causes the oven to switch off. The timer is clockwork-actuated and registers up to 2 hours. The thermostat control knob has the figures 1 - 8 on it but no temperature equivalents. There is also a pilot light.

The purpose of this trial was to establish the temperature at different settings, the efficiency of the hot air circulated, the time taken to reach different temperatures and the ability to sterilize instruments and, in an emergency, some dressings such as gauze and cotton-wool balls.

The temperature readings were done with self-adhesive temperature labels (RS Components, London) with 1% accuracy. A colour change from white to black indicated that the rating quoted on the indicator had been exceeded. These labels were put onto kidney bowls, glass specimen jars with metal lids, test tubes and test tubes inside a larger test tube plugged with cotton wool. A temperature label was also placed on the outside of the glass dome. The inner test tubes were used to see if there was adequate circulation of hot air into confined spaces. Cotton-wool balls and gauze squares were also placed in small bowls in the oven to see whether the high temperature altered the colour and texture of the dressings. Instruments that were cleaned before-hand did not discoulour, rust or accumulate any debris. The clear glass oven top allowed visualization of what was in the sterilizer.

Over the past 50 years or more boiling water in various types of containers has been used for the sterilization of small instruments, bowls and kidney dishes in doctors’ consulting rooms. The maximum temperature reached in this way is 100°C or less. Dressings such as gauze swabs, cotton-wool balls, etc. are sterilized in drums which are autoclaved, usually in nursing-home theatres. Few doctors have their own autoclaves.

Sterilization in boiling water has the following disadvantages: (i) the water takes some time to come to the boil, depending on the size of the sterilizer; (ii) because the temperature is only 100°C or less, the boiling period must be prolonged; (iii) this temperature does not kill hepatitis B virus and some spores; (iv) the sterilizer can boil dry if unattended; (v) the steam generated in small rooms causes fogging of windows and condensation; (vi) rust and ‘sterilizer debris’ form, requiring frequent scouring of the apparatus; and (vii) the cost of sterilizers is now very high and, in our experience, many do not last more than a few years.

An alternative method of sterilization is provided by hot air, and it was decided to investigate this using domestic fan-assisted hot-air ovens of which many different models are available on the local market. The element and fan are not exposed and hot air is circulated by the fan causing an even and constant temperature throughout the oven.

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