The Royal Australian and New Zealand College of Radiologists®

Imaging in occupational lung disease due to exposure to dust from engineered stone

DRAFT FOR CONSULTATION

1. Introduction

Australia has identified a significant incidence of disease in workers exposed to the dust from high silica content engineered stone. Whilst there have been no reported cases in New Zealand, similar patterns of disease are anticipated due to similar products being used across both countries. Imaging has a central role in the diagnosis and monitoring of occupational lung diseases including disease resulting from exposure to engineered stone (1).

The spectrum of diseases associated with respirable crystalline silica includes:

- Silicosis
- Lung cancer
- Chronic obstructive pulmonary disease (COPD)
- Tuberculosis
- Scleroderma
- Rheumatoid arthritis
- Chronic kidney disease.

In Australian workers the spectrum of lung disease being identified includes accelerated silicosis without calcified hilar or mediastinal lymphadenopathy, chronic silicosis complicated by progressive massive fibrosis, and lymph node enlargement (2).

Engineered stone workers may present for chest imaging as part of screening programs or undergo imaging for unrelated reasons.

2. Role of the Clinical Radiologist

Clinical Radiologists are medical specialists who are experts in diagnostic imaging. The role of Clinical Radiologists in occupational lung disease is to use their expert knowledge to detect and characterise abnormalities and provide a definitive diagnosis or differential diagnosis to assist with informing disease management (3). Accurate diagnosis of occupational lung disease with low inter-reader variability is highly desirable for clinical, research and medicolegal reasons.

3. Role of chest X-ray versus high resolution computed tomography (HRCT) chest

3.1. Australian experience with imaging of engineered stone workers

Preliminary review of data from Australian centres caring for workers with engineered stone related lung disease has found that chest X-rays are failing to reliably detect disease (in one cohort 46% of International Labour Organisation (ILO) classified chest x-rays in Queensland workers <u>*did not detect disease*</u> that was visible on CT) (2,4). This level of false negatives is not acceptable in a screening environment. A range of interstitial lung abnormalities have been identified on HRCT in engineered stone workers, including subtle findings such as small ground glass attenuation nodules. The relationship of some of the findings to morbidity and outcomes is uncertain.

HRCT has already replaced the chest X-ray in the diagnosis of non-occupational diffuse lung diseases and has been recommended for use in occupational lung diseases (5,6). While historically chest X-ray has been the primary imaging modality used to detect lung disease due to silica exposure, HRCT has a higher sensitivity for detecting early disease, and greater accuracy in characterising the patterns of disease (5,6). For these reasons, and in the context of the findings described in Australian workers, HRCT of the chest is strongly recommended as the primary imaging modality to be used for screening exposed workers.

3.2. Role of chest x-ray and HRCT classification systems

Classification systems exist for use with chest X-ray and HRCT in the context of occupational lung disease. Use of these classification systems complements and does not replace the requirement for a diagnostic imaging report. These systems are intended to reduce inter-reader variability through standardising the classification of abnormalities. They support comparisons of data, research and have utility in medicolegal settings such as compensation claims (7,8).

The International Labour Organisation (ILO) has guidelines for the classification of radiographs of pneumoconiosis that were developed to standardise classification of lung opacities and facilitate international comparisons of data (9). Although the ILO system is not used for patient care it has a role in screening and surveillance, and for medicolegal purposes. The National Institute for Occupational Safety and Health (NIOSH) in the USA oversees A and B reader programs to train and document proficiency of physicians who use the ILO classification for pneumoconiosis (10,11).

An equivalent classification system has been developed for HRCT. The International Classification of High-resolution Computed Tomography (HRCT) for Occupational and Environmental Respiratory Diseases (ICOERD) was developed for the screening, diagnosis, and epidemiological reporting of respiratory diseases caused by occupational exposures (8). The target of this classification is asbestos-related pulmonary diseases, silicosis, and tobacco exposure-related respiratory diseases such as emphysema.

4. Recommendations

4.1. General Recommendations

- RANZCR will ensure its membership is kept up to date on the emerging issue of occupational lung disease in engineered stone workers and any related recommendations.
- As engineered stone workers may present for chest imaging as part of screening programs or undergo imaging for unrelated reasons, it is important that all Clinical Radiologists are aware of the need to consider occupational lung disease in the differential diagnosis of abnormalities on chest x-ray or HRCT.
- In conjunction with other stakeholders, RANZCR will seek to raise general awareness amongst community and hospital health care providers of the importance of including relevant history about occupational and non-occupational exposures associated with an increased risk for lung disease in the clinical details provided on referrals for imaging.
- In partnership with its special interest group, the Australian and New Zealand Society of Thoracic Radiology (ANZSTR) RANZCR will:
    - Advocate for Clinical Radiologist participation in taskforces, working groups and other initiatives relating to engineered stone (and other occupational lung

disease), including those led by other professional bodies, government and non-government agencies.
    - Facilitate dissemination of specific CPD resources and support provision of educational opportunities to assist members in the development and maintenance of skills in diagnosing and characterising occupational lung disease.

4.2. Specific recommendations related to diagnosis, imaging and reporting of occupational lung disease due to engineered stone

4.2.1. Investigation pathways for workers at risk of occupational lung disease from engineered stone exposure

- The wellbeing of workers is paramount.
- Pathways for the diagnosis of occupational lung disease due to engineered stone should be evidence based and free of commercial bias.
    - All individuals advising on or participating in pathway design should be asked to disclose any conflicts of interest (disclosure should be documented).
- Pathways should be developed through a multidisciplinary consensus building process including Clinical Radiologists as the imaging experts.
- Pathways should be as consistent as reasonably achievable across Australia and New Zealand.
- The limited sensitivity of chest X-ray for the detection of disease needs to be acknowledged in the pathway development process. HRCT is strongly recommended for screening all exposed workers. Participants in pathway design should actively consider how to lower/remove barriers to accessing HRCT.
- In addition to via screening, pathways should accommodate any at risk worker with pulmonary or pleural abnormalities incidentally detected on chest X-ray or HRCT performed for non-occupational indications being able to access specialist review.
- A multidisciplinary approach to establishing a diagnosis of interstitial lung disease (ILD) due to occupational exposure is strongly recommended.
    - Clinical Radiologists are integral members of the Occupational ILD multidisciplinary team.
    - In the New Zealand practice environment regional Occupational ILD services are recommended as the access point for multidisciplinary review.

4.2.2 Imaging technique recommendations

HRCT is strongly recommended for screening all workers at risk of occupational lung disease from engineered stone exposure.

a) HRCT technique:

High resolution (HR) images are required to detect and characterise occupational lung disease. A volumetric HRCT of the entire chest at end inspiration is recommended along with expiratory HRCT images at a 20 mm interslice gap.

- The entire lungs should be assessed without an interslice gap. Scan range for the inspiratory acquisition should extend from lung apices to the costophrenic sulci. Contiguous high resolution (HR) images should be reconstructed at 0.625-mm to 1.5-mm slice thickness with a high spatial frequency reconstruction algorithm (12).
- Prone HRCT images should only be used in selected cases where they will add value i.e., they should not be routinely performed.

- Utilisation of techniques to optimise dose is recommended. Care should be taken to ensure image quality supports the detection of subtle abnormalities including small ground glass attenuation nodules.
- Intravenous contrast should not be used when performing HRCT for suspected diffuse interstitial lung disease as intrapulmonary contrast can obscure subtle pulmonary findings (12).

b) Chest X-ray technique:

Although chest X-ray lacks sensitivity and cannot characterise disease as accurately as HRCT, a baseline chest X-ray is recommended in combination with HRCT. In selected cases this could allow a chest X-ray to be used as an alternative to HRCT in ongoing follow-up. A quality PA chest X-ray optimised for assessing the lungs is recommended as a baseline test in conjunction with a HRCT chest (6,13,14).

c) Reporting recommendations

All examinations undertaken to screen for occupational lung disease due to engineered stone require a diagnostic imaging report by a Clinical Radiologist.

To assist with reducing inter-reader variability and help standardise report content, use of standard report templates for chest X-ray (appendix 1) and HRCT are strongly recommended (appendix 2).

To ensure there is clarity with respect to the final interpretation of a chest X-ray and HRCT, use of standardised comments is strongly recommended, and where appropriate, use of standardised recommendations aligned with local pathways is strongly recommended (appendix 1 and 2).

To reduce the risk of a false negative interpretation of chest X-ray or HRCT it is strongly recommended that any examinations initially interpreted as normal are double read. This may be attained through multidisciplinary meeting (MDM) review.

Reporting of the imaging of occupational lung disease should be undertaken by Clinical Radiologists with experience in the interpretation of chest X-rays and HRCT for interstitial lung disease, familiar with the patterns seen in occupational lung disease, and the common differential diagnoses.

The Clinical Radiologists reporting silicosis screening should have expertise in thoracic imaging including the imaging of interstitial lung disease.

Clinical Radiologists reporting chest X-rays and HRCT for occupational lung disease must be aware of known or suspected occupational lung disease at the time of reporting and should also be regularly reporting chest X-rays and HRCT for other ILDs.

Clinical Radiologists reporting HRCT for occupational ILD should participate in interstitial lung disease multidisciplinary meetings at established ILD sites (or an equivalent review group).

Clinical Radiologists reporting HRCT for occupational lung disease should be undertaking CPD activities specific to imaging of ILD including due to occupational exposures:

- A minimum of 15 occupational lung disease specific points per triennium is recommended. These can be recorded in the RANZCR CPD portal.

- It is strongly recommended that Clinical Radiologists reporting chest X-rays and HRCT for ILD in general and occupational lung disease incorporate peer review of performance and peer discussion of occupational lung disease cases amongst their CPD activities.

RANZCR will, in conjunction with its thoracic imaging special interest group (The Australian and New Zealand Society of Thoracic Radiology – ANZSTR), encourage and facilitate the sharing of experience and knowledge and the development of evidence-based guidelines to support its members to provide quality care to workers with suspected occupational lung disease.

Appendix 1: Chest X-ray reports in suspected occupational lung disease should contain the following:

Clinical information

Technique
PA chest X-ray

Exam quality
Specify if:
Satisfactory positioning *(costo-pleural junctions included)*
Satisfactory exposure (*fine detail of parenchymal markings visible, vascular markings visible through heart) or* underexposure *(may over-call profusion) or o*verexposure *(may under-call profusion)*

Findings
Fibrotic abnormalities
Specify presence/absence of chest X-ray findings suggesting:
  - Reticular abnormality
  - Traction bronchiectasis, bronchiolectasis
  - Honeycombing

Non-fibrotic Abnormalities
Specify presence/absence of chest x-ray findings suggesting:
- Diffuse pulmonary opacity
  - Consolidation
  - Ground glass opacity
  - Crazy paving
- Nodules
- Airway abnormalities
  - Mosaic attenuation/air-trapping
  - Bronchial wall thickening, bronchiectasis
  - Emphysema, cysts

Masses
Specify presence/absence of chest x-ray findings suggesting:
- PMF/conglomerate
- Rounded atelectasis
- Bronchogenic carcinoma

Other findings
Specify presence/absence of chest x-ray findings suggesting:
- Lymph node enlargement including whether hyperdense or calcified
- Pleural abnormality
- Pulmonary arterial enlargement
- Oesophageal dilation, hiatal hernia,

Impression
Specify imaging classification based on chest x-ray:
- No evidence of occupational exposure related disease.

or
- Abnormalities are present that may be due to occupational exposure related disease. HRCT chest recommended.
  - Differential diagnosis with level of confidence
  - Change since prior imaging

Adapted from Chung C, Lynch D and Cox CW et al (5,15).

Appendix 2: CT reports in suspected occupational lung disease should contain the following:

Clinical information

Technique
HRCT whole chest 1 mm, expiratory HRCT

Exam quality

Fibrotic abnormalities

- Specify presence/absence of and axial and craniocaudal distribution of:
    - Reticular abnormality
    - Traction bronchiectasis, bronchiolectasis
    - Honeycombing

Non-fibrotic Abnormalities
Specify presence/absence of:

- Diffuse pulmonary opacity
    - Consolidation
    - Ground glass opacity
    - Crazy paving
- Nodules
    - Specify if solid or ground glass attenuation, and distribution perilymphatic/subpleural or centrilobular or random
- Airway abnormalities
    - Mosaic attenuation/air-trapping
    - Bronchial wall thickening
    - Bronchiectasis
    - Emphysema
    - Cysts

Masses
Specify presence/absence of:

- PMF/conglomerate
- Rounded atelectasis
- Bronchogenic carcinoma

Other findings

- Specify presence/absence of:
    - Lymph node enlargement including whether hyperdense or calcified
    - Pleural abnormality
    - Pulmonary arterial enlargement
    - Oesophageal dilation
    - Hiatal hernia

Impression

- It is recommended that the final diagnosis of occupational exposure related disease is made by multidisciplinary consensus therefore a simple classification at the end of each report is recommended:
    - No evidence of occupational exposure related disease.

    or

    - Abnormalities are present that may be due to occupational exposure related disease. Multidisciplinary review is recommended.

- Alternative imaging classification:
    - Consistent with, or probable, or indeterminate, for occupational exposure related disease or most consistent with a non-occupational disease diagnosis.
- Differential diagnosis with level of confidence
- Change since prior imaging

Adapted from Chung C, Lynch D and Cox CW et al (5,15).

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