Population Covered By The Guidance

This pathway provides guidance on the imaging surveillance of adult patients with subsolid pulmonary nodules.
This pathway is based on guidelines that do not apply to patients younger than 35 years, immunocompromised patients or patients with cancer.

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Quick User Guide

Move the mouse cursor over the PINK text boxes inside the flow chart to bring up a pop up box with salient points.
Clicking on the PINK text box will bring up the full text.
The relative radiation level (RRL) of each imaging investigation is displayed in the pop up box.

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Pathway Diagram
Teaching Points

- A pulmonary nodule is radiologically defined as an opacity

**Pulmonary Nodules**

- A pulmonary nodule is radiologically defined as an intra-parenchymal rounded or irregular opacity less than 3cm in diameter and not associated with atelectasis or lymphadenopathy. Lesions that are larger than this are generally referred to as masses and are more likely to
be malignant 1

- Pulmonary nodules can be further classified according to their attenuation on computed tomography (CT). A solid nodule has homogenous soft-tissue attenuation. Subsolid nodules include pure ground-glass nodules (focal area of hazy increased attenuation through which bronchovascular margins can be visualised) and part-solid nodules (consisting of both solid soft-tissue attenuation and ground-glass components) 1

- The widespread use of multi-detector CT has made it commonplace to detect pulmonary nodules often when they are sub centimetre in size. Nodules may be detected incidentally (on chest radiographs, chest CT or imaging for other purposes) or in some countries, through lung screening programs. The majority of these nodules have a benign aetiology but a small proportion represent malignancy and if detected early, may be cured

- The primary aim of investigation is to determine which nodules are malignant early whilst minimising patient exposure to ionising radiation and limiting the number of unnecessary invasive procedures

- This pathway presents an evidence-based and consensus-based approach to the investigation and management of subsolid pulmonary nodules

- Distinguishing solid from subsolid features is an essential step in the evaluation of pulmonary nodules 2

**Subsolid Nodules**

- Subsolid nodules (SSN), also referred to as ground glass nodules (GGN), are defined as a circumscribed area of increased lung attenuation with preservation of the bronchial and vascular margins 3

- An SSN can be a part-solid GGN (part of the nodule completely obscures the underlying lung parenchyma) or a pure GGN (no completely obscured areas) 4,6

- Pulmonary subsolid nodules have a high likelihood of malignancy, but are often indolent and caused by inflammation, infection, or fibrosis 5, 7, 8

- Although transient SSNs can represent a large range of benign diseases, persistent SSNs have a high likelihood of malignancy, with reported malignancy rates ranging from 19.4% to 75%. (9) These malignancy rates are much higher than the likelihood of malignancy of solid pulmonary nodules (34% for pure ground glass and 63% for part-solid compared to only 7% for solid nodules 10, 11

- Since SSNs usually have a slow growth rate with a high likelihood of malignancy, follow-up guidelines for solid pulmonary nodules are not appropriate for SSNs 5, 6

**Pure Ground Glass Nodule**

- Pure Ground Glass Nodules are defined as focal nodular areas of increased lung attenuation through which lung parenchymal structures, such as the pulmonary vessels or bronchial structures, can be observed 3, 12

**Part Solid Nodule**

- Part solid nodules are nodules that present with both ground-glass and solid components in which the underlying lung architecture cannot be visualized 11

- The solid component may represent the invasive foci of adenocarcinomas although other histologic changes, such as alveolar collapse, inflammation and fibrosis may also appear as
a solid region of SSNs on CT 11, 13
- Since the management plan for part-solid GGNs is determined by the size of the solid portion, it is important that both the solid component size as well as the total tumour size is reported 11, 14

**Thin Section Computed Tomography (CT)**

- CT with the thinnest slices possible is the initial investigation of choice for the evaluation of pulmonary nodules 12, 15, 16
- The ground glass component should be evaluated on the lung window with an edge-enhancing (sharp) filter to judge the presence and extent of solid components 6
- It can distinguish true lung nodules from lesions of the chest wall, pleura and imaging artefact 17
- It can identify features that suggest a benign or malignant process such as
  - Ground-glass lesions that are ≤6 mm in diameter usually represent atypical alveolar hyperplasia
  - Ground-glass lesions that are between 5 and 10 mm in diameter are suspicious for bronchioalveolar carcinoma
  - Part solid lesions may represent the mixed subtype of adenocarcinoma, also called minimally invasive adenocarcinoma 18, 19
- Surveillance strategies utilising CT have been developed for the follow-up of patients with low risk pulmonary nodules. 15, 16, 20 Five years of radiographic stability on surveillance CT strongly suggest that the lesion is benign, obviating long-term surveillance 6, 21

**Positron Emission Tomography / Computed Tomography (PET / CT)**

- Studies have also shown that the use of PET/CT to discriminate between benign and malignant subsolid nodules to be inappropriate 22
- PET/CT is of limited value and even potentially misleading for pure ground glass nodules (GGN) as small pure GGNs are usually negative at PET 3
- The Fleischner Society only recommend considering PET-CT for nodules with particularly suspicious morphology (ie, lobulated margins or cystic components), a growing solid component, or a solid component larger than 8 mm 3, 5, 6

**References**

**Date of literature search: February 2017**

References are graded from Level I to V according to the Oxford Centre for Evidence-Based Medicine, Levels of Evidence. [Download the document](#)

   Recommendations for the management of subsolid pulmonary nodules detected at 

4. Heuvelmans MA, Oudkerk M. Management of subsolid pulmonary nodules in CT lung 

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    (Guidelines) View the reference.

    management of small pulmonary nodules detected on CT scans: a statement from 


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