

# An Audit on Repeat imaging in patients who were admitted with Pneumonia

Nicholas Tabone Adami, Darren Borg , Sylvana Scerri, David Bilocca

**Aim:** To assess compliance with British Thoracic Society recommendations for repeat chest imaging following hospital admission with community-acquired pneumonia. Secondary outcomes included radiological resolution, persistent consolidation, and detection of underlying malignancy.

**Methods:** A retrospective audit was performed of patients admitted with community-acquired pneumonia to Mater Dei Hospital during the first six months of 2023. Data regarding patient demographics, risk factors, repeat imaging, imaging findings, and subsequent investigations were collected and analysed.

**Results:** A total of 273 patients were included, with repeat imaging performed in 54.1% of patients aged >50 years, 54.2% of those aged <50 years, and 55.2% of patients with a previous history of malignancy. Most patients demonstrated complete radiological resolution, while persistent consolidation was identified in 22 patients. Only one case of lung malignancy was diagnosed following repeat imaging, corresponding to a diagnostic yield of 0.37%.

**Conclusions:** Compliance with guideline-recommended follow-up imaging was approximately 54% across all patient groups. Although the diagnostic yield for lung malignancy was low, repeat imaging remains important for identifying persistent abnormalities that may require further investigation.

**Dr Nicholas Tabone Adami**  
**MD, MRCP (UK)**

Department of Medicine,  
Mater Dei Hospital,  
Msida, Malta

**Dr Darren Borg, MD, MRCP(UK)**

Department of Medicine,  
Mater Dei Hospital,  
Msida, Malta

**Dr Sylvana Schembri, MD**

Department of Medicine,  
Mater Dei Hospital,  
Msida, Malta

**Dr David Bilocca, MD, MRCP(UK)**

Department of Medicine,  
Mater Dei Hospital,  
Msida, Malta

Patients who have had a consolidation present on Chest X-Ray (or another imaging modality of the chest) are commonly required to have repeat imaging for assessment of resolution of the original findings, approximately in 6 weeks from the original radiograph/scan. The British Thoracic Society Guidelines (BTS) for the management of community-acquired pneumonia recommend repeat imaging in 6 weeks, along with a clinical review, in those patients with persistent symptoms or those at a higher risk of malignancy (for example those who have a history of smoking, or being more than 50 years of age).<sup>1</sup>

AIM OF AUDIT

The aim of the audit is to assess the number of patients who have actually had repeat imaging to assess resolution of the original consolidation, data being obtained from admissions over a 6-month period in the first half of 2023. There will also be assessment of whether any further investigations took place if the repeat imaging is abnormal, including bronchoscopy. Data will include the percentage of the patients that have a confirmed histological diagnosis of malignancy after the repeat imaging. Patients with known lung cancer at the time of admission to hospital, will be excluded from the audit.

METHODOLOGY

All patients who were admitted in Mater Dei Hospital with pneumonia, over a 6-month period in the first half of 2023, will be assessed on whether there was repeat imaging after 6 weeks from the original detection of the consolidation. There will also be collection of data on the age (whether more than 50 or not), whether there is any smoking history, use of immunosuppressive drugs and whether there was

any history of previous malignancy prior to the presentation, therefore stratifying those with a higher risk of malignancy as a separate group. Furthermore, we will be assessing who followed up the repeat chest X-ray after 6 weeks, whether it was a primary health care physician or the original caring firm. All data will be anonymized and will be deleted after processing.

The exclusion criteria in the audit were as follows:

- Patients less than 16 years of age
- Currently with malignancy on active treatment
- Deceased prior to repeat CXR Date
- Patients who did not attend to follow-up
- Patients who went abroad after discharge

RESULTS

A total of 273 patients satisfied the inclusion criteria for this audit. These patients were divided into 3 sub-categories:

- Patients over 50 (220 patients)
- Patients under 50 (24 patients)
- Patients with a previous history of malignancy (29 patients)

In the over 50 category, the average age of patients with a detectable consolidation on chest X-ray was 79. The minority of these patients had a smoking history, with 15 patients (6.8%) being smokers at the time of investigation, with a further 33 patients (15%) being ex-smokers. Only 5 patients had a history of immunosuppression. As demonstrated in [Table 1](#), out of 220 patients in this category, 119 patients (54.1%) underwent repeat imaging. In these patients, the most common repeat imaging modality of choice was a chest X-ray, with 113 patients (94.9%) having a repeat chest X-ray and only 6 patients undergoing

**Table 1** Proportion of patients who had repeat imaging, stratified according to their age or history of malignancy. Note: For Smoking History, the number of patients who were current or ex-smokers are indicated

|                                 | >50 years of age | <50 years of age | History of malignancy |
|---------------------------------|------------------|------------------|-----------------------|
| Consolidation Detected on CXR   | 220              | 24               | 29                    |
| Average Age                     | 79               | 42               | 74                    |
| Smoking History                 | 48               | 10               | 13                    |
| Patients with repeat Imaging    | 119              | 13               | 16                    |
| Patients without repeat imaging | 101              | 11               | 13                    |

**Table 2** Reason for no repeat imaging being performed, according to age or history of malignancy

|                                                                           | >50 years of age | <50 years of age | History of malignancy |
|---------------------------------------------------------------------------|------------------|------------------|-----------------------|
| <b>Left country prior to repeat imaging</b>                               | 2                | 1                | 0                     |
| <b>Deceased prior to repeat imaging</b>                                   | 46               | 1                | 8                     |
| <b>Had further imaging within the 6-week span showing normal findings</b> | 5                | 3                | 2                     |
| <b>Confirmed Thoracic Malignancy prior to repeat CXR date</b>             | 2                | 0                | 3                     |
| <b>No reason found</b>                                                    | 46               | 6                | 0                     |

cross-sectional imaging in the form of CT, as seen in [Table 2](#).

The most common outcome in patients undergoing repeat imaging following a consolidation was complete resolution in 100 patients (84%). Other outcomes included persistence of the consolidation in 17 patients (14.3%) and solitary cases of organizing pneumonia and lung malignancy.

The remaining 101 patients over the age of 50 did not undergo repeat chest X-ray. As highlighted in [Table 3](#), the most common reasons for this was found to be death in the 6-week period following initial chest X-ray and follow-up chest X-ray (46 patients, 45.5%) and patients failing to attend for repeat chest X-ray (46 patients, 45.5%). 2 patients (1.98%) did not undergo a repeat chest X-ray as lung malignancy was confirmed using an alternative imaging modality before the 6-week period for a repeat chest X-ray had elapsed.

In the under 50 category, the average age of patients with a detectable consolidation on chest X-ray was 42. A total of 6 patients (25%) were current smokers, with a further 4 patients (16.7%) being ex-smokers. Only 2 patients in this category were immunosuppressed.

Out of a total of 24 patients under the age of 50, 13 patients (54.2%) underwent repeat imaging. Similar

to the over 50 category, the most common repeat imaging modality was a chest X-ray, with 11 (84.6%) of patients undergoing a repeat chest X-ray. The remaining 2 patients underwent a CT scan. In the 13 patients who underwent repeat imaging, 10 patients (76.9%) had complete resolution of consolidation, with a further 3 having persistence of consolidation. All 3 of these patients did not have any further imaging, so we are unable to comment on the possible underlying aetiology of the consolidation. There were no cases of organizing pneumonia or malignancy diagnosed in this category.

A total of 29 patients in this audit had a consolidation detected on chest X-ray with a history of previous malignancy. The average age of these patients was 74 years, and the most common type of malignancy was breast cancer (8 patients, 27.6%). Gastro-intestinal, urological, and haematological malignancies made up the majority of remaining cases (16 patients in total, 55.2%). Only 3 (10.3%) of patients had a history of previous lung malignancy.

A total of 6 patients (20.7%) had a smoking history, with a further 7 patients (24.1%) being ex-smokers. 16 patients (55.2%) in this category underwent repeat imaging. In this case, chest X-ray was still the most common imaging modality of choice, with 11 patients (68.8%) undergoing repeat chest X-ray.

**Table 3** Repeat Imaging modalities and findings according to age and history of malignancy

|                                      | >50 years of age   | <50 years of age  | History of malignancy |
|--------------------------------------|--------------------|-------------------|-----------------------|
| <b>Chest X-Ray (CXR) or CT Scan</b>  | CXR – 113 / CT – 6 | CXR – 11 / CT – 2 | CXR – 11 / CT – 5     |
| <b>Resolution of Consolidation</b>   | 100                | 10                | 14                    |
| <b>Consolidation still present</b>   | 17                 | 3                 | 2                     |
| <b>Signs of Organising Pneumonia</b> | 1                  | 0                 | 0                     |
| <b>Evidence of Malignancy</b>        | 1                  | 0                 | 0                     |

However, 5 patients (31.2%) proceeded immediately to cross-sectional imaging in the form of a CT scan.

In patients who underwent repeat imaging, 14 patients (87.5%) had complete resolution of the consolidation whilst the remaining 2 patients had persistence of the consolidation. One patient underwent repeat imaging within the 6-week time frame which showed partial improvement of the consolidation. This was further investigated by a 3rd repeat chest X-ray after 8 weeks which then confirmed resolution of the consolidation. One possible explanation for the slower resolution of this consolidation is that this patient was grossly immunosuppressed by immunotherapy as part of treatment for metastatic breast cancer.

The second patient with a persistent consolidation was not investigated further due to severe frailty and co-morbidity. The patient was also grossly immunocompromised with severe neutropenia secondary to myelodysplastic syndrome and passed away within 3 weeks of repeat chest X-ray.

13 patients (44.8%) did not undergo repeat imaging, the most common reason being death in the 6-week period between repeat imaging (8 patients, 61.5%). However, 3 patients underwent cross sectional imaging before the 6-week period elapsed and were confirmed to have lung malignancy.

In this audit, a total of 22 patients were found to have consolidations which were persistent on repeat chest X-ray. 16 of these patients did not have any further imaging investigations. From the remaining 6 cases who underwent repeat imaging, the following lung pathologies were identified:

- Post-covid organizing pneumonia.
- Bronchiectasis
- Two cases of recurrent aspiration pneumonia in patients with nasogastric tubes
- Recurrent aspiration pneumonia in patients with Huntington's disease
- COVID pneumonitis with ground glass opacification

## DISCUSSION

Similar audits and studies can be found in the literature, which assess adherence to repeat imaging in a 6-week period. Results vary across the literature,

## SUMMARY BOX

- Follow up rates for repeat chest x-ray did not vary with age, with 54.1% follow up in patients over 50 and 54.2% in patients under 50.
- The rate of follow up chest x-ray has increased marginally compared to a local audit performed in 2019.
- Repeat chest radiograph has a poor diagnostic yield for lung malignancy based on this audit.

one study by Tang et al mentioning less than half the patients in a 2 year period of having repeat imaging, (2) as well as another retrospective study by Bryl et al concluding only 55% of those deemed as high risk (>50 years of age or a smoking history) as having repeat imaging.<sup>3</sup> On the other hand, a study by Upperton et al found that 88% had repeat imaging.<sup>4</sup> Whilst the risk of radiation from imaging should be considered, it must however also be emphasized that the importance of re-assessment of a consolidation should take place to exclude malignant disease and/or atypical infections which may give a prolonged clinical course, associated with further morbidity and mortality.

A similar audit by Delicata et al was performed locally between 2013-2016 which analyzed the outcomes of the follow-up of consolidations.<sup>5</sup> Some striking differences between the two audits however, was that the previous audit did not take into account patients under the age of 50. Furthermore, the previous audit allowed for a 12-week time window in which patients could repeat chest X-rays following consolidation.

Despite these differences, the results between the two audits were congruent, with the audit by Delicata et al revealing a 53.2% follow up rate of repeat chest X-ray, compared to the 54.1% (in patients over 50) and 54.2% (in patients under 50) follow up rate in this audit.

Furthermore, the study demonstrated that the diagnostic yield of lung malignancy was found to be 1.74%. In this audit, the diagnostic yield of repeat chest X-ray was only found to be 0.37%. Reasons which could explain the lower diagnostic yield include the smaller sample size in this audit and the fact that younger patients, who are much less likely to be diagnosed with malignancy, were included.

## REFERENCES

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