An evaluation of the use fast track CT to better select patients for lung cancer clinics

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Aims and objectives

**Aim and Objectives:** To analyse the cases referred for a fast track CT by the radiologists based on a chest radiograph finding in the radiology department of the James Paget University Hospital.

**Background:**

Lung cancer is the leading cause of cancer deaths in the UK\[i\]. At present the 10 year survival rate from lung cancer is still only 5%. This is because most lung cancers are diagnosed at a more advanced stage with 67.6% diagnosed at stage III or more and therefore have a poorer prognosis\[ii\]. Only 5% of lung cancer patients are alive at 10 years\[i\]. To help improve this early diagnosis and management of lung cancers is crucial. Studies have shown that early access to investigations including CT and histology leads to earlier diagnosis which in turn is likely to increase the proportion of patients suitable for curative treatment\[iii\]. The role of the radiology department in England is to pick up these cancers on imaging, mainly starting from the abnormal chest radiograph then CT, and triage appropriately via a 2 week referral system to the lung cancer team depending upon the local arrangements which will then lead to a multi-disciplinary team (MDT) discussion as outlined by the National institution of clinical excellence (NICE) guidelines\[iv\]. However, not all abnormal chest radiographs are due to cancer and referring all these patients to the chest physicians and lung cancer team before a CT chest scan will inadvertently put pressure on the system, is costly and risks longer waiting times for those patients who are positive for lung cancer.

**Introduction:**

In agreement with local general practitioners (GPs) and trust physicians, the radiology department at the James Paget University Hospital has designed a service which enables their radiologists to organise an urgent chest CT scan within 2 weeks for suspicious chest radiograph appearances. This is in order to expedite diagnosis of pulmonary malignancies in an effort diagnose the cancer at a less advanced stage, reduce the time to treatment as well as better select patients for the lung cancer multidisciplinary discussion. The purpose is simple; to ensure early diagnosis of lung cancer with the view to saving more lives.

We aim to evaluate this new pathway. Is it effective and efficient? Does it reduce waiting times and does it reduce the number of referrals to the respiratory physicians.

1. Effectiveness - number of cancers picked up, less patients referred to the lung cancer MDT.
2. Efficiency - based on the previous local lung cancer audit in 2011 when a different pathway was in place we know that the average length of time to histological diagnosis was 6 weeks [v].


Methods and materials

Methodology:

Retrospective analysis of all patients referred for a fast track CT based on an abnormal chest radiograph by the JPUH radiologist services was compiled for a 9 month period between November 2013 and July 2014. The patient demographics, chest radiograph and CT scan results were pulled for each patient and analysed.

Patients with a known malignancy were excluded.

The data was collected from the hospital electronic systems including the Radiology Information System (CRIS) and PACS.

The specific data parameters collected are demonstrated in the table below:

<table>
<thead>
<tr>
<th>Patient No.</th>
<th>Age</th>
<th>Date of Chest X-Ray</th>
<th>Date of CT</th>
<th>Smoking status</th>
<th>Chest X-ray report</th>
<th>CT Finding</th>
<th>Indicated</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Yes/No</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Normal</td>
<td>Abnormal</td>
</tr>
</tbody>
</table>

With the cancer diagnoses pathological confirmation was used where radiology was equivocal.

Chest radiographs were evaluated by 2 radiologists, a radiology trainee and a chest radiologist, blinded to the CT findings and they arrived at a consensus about the justification of the CT based on the chest radiograph findings. No cancers or suspicious findings were detected where 2 radiologists thought that CT was not justified.
Results

A total of 214 patients were referred for a fast track CT by the radiologists based on an abnormal chest radiograph between November 2013 and July 2014. Of these, 9 patients were excluded; 4 had a known lung cancer, 3 did not attend for CT scan, 2 died before CT and 1 was not a GP referral.

205 patients were, therefore, included in the study. Of these, 39 (19%) had a lung malignancy, 41 (20%) patients had normal CT results and overall 164 (80%) patients had an abnormal CT.

Of the abnormal CTs 46% had 'benign' abnormalities, classed as those which did not require any management such as rib fractures and pleural plaques. The 15% 'significant abnormal' results referred to those that required management for example the case in the images section below demonstrates a pulmonary infarct secondary to a pulmonary embolus. Of the 148 abnormal CT results 26% patients had a 'malignancy' result. See figures 1-5.

Case Distribution:

Table 1.

<table>
<thead>
<tr>
<th>CT Chest Result</th>
<th>Number of Cases</th>
<th>Positive Predictive value</th>
<th>Average time to scan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal CT</td>
<td>20 % (41)</td>
<td></td>
<td>15.5 days</td>
</tr>
<tr>
<td>Abnormal CT (not cancer)</td>
<td>61 % (125)</td>
<td>19%</td>
<td>(13.9 days for malignancy)</td>
</tr>
<tr>
<td>Cancer CT</td>
<td>19 % (39)</td>
<td>19%</td>
<td></td>
</tr>
</tbody>
</table>

Table 2:

Commons Reasons for 'Not indicated'

<table>
<thead>
<tr>
<th>Cases out of total (54)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overcall</td>
</tr>
<tr>
<td>Not reviewing previous imaging</td>
</tr>
</tbody>
</table>
Discussion:

The study does demonstrate that new pathway leads to reduced scan time as there are no clinic/general practice appointments needed between the chest radiograph and the chest CT.

Subtle findings were investigated by CT rather than followed up by chest plain radiographs which also expedited the detection of cancers earlier and increased the detection of early stage cancers which were radically treatable.

Out of 205 abnormal chest radiographs less than 20% were positive for cancer giving the suspicious chest radiograph a positive predictive value for cancer of 19%. This means 80% of patients did not require referral to the lung cancer multidisciplinary meeting.

Although only 19% of patients had cancer on CT chest, it is reassuring to see that 3 of our radiologists (requesting radiologist, radiology trainee and chest radiologist) agree that at least 74% of the CT scans performed were indicated. However, there is scope for improvement.

A review of the 26% non-indicated cases has been done and will be fed back to the department at the local clinical governance meeting for learning purposes. Overcalling, poor use of previous imaging and lack of appreciation of benign chest radiograph appearances led to the non-justified CTs.

The average waiting time for a CT chest following an abnormal chest radiograph from a general practice request was 15.5 days overall and 13.9 days in the positive cancer cases in line with our national target of 2 weeks.
Fig. 1

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Fig. 2

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Fig. 3
Fig. 4

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**Fig. 5:** Chest radiograph shows a right mid zone peripheral wedge-shaped area of consolidation with a band of atelectasis extending to the hilum. This was fast tracked for a two week chest CT which showed a pulmonary infarct secondary to a pulmonary embolus as shown on the CT image below.

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Fig. 6: CT pulmonary angiogram: There is an embolus in the right pulmonary artery and an associated peripheral wedge infarct as shown in the plain film above.

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Fig. 7: CXR: Enlarging right upper lobe nodule overlying the right fourth rib posteriorly. A fast tract CT was organised shown below in figure 8 which showed a 2cm right upper lobe nodule which was proven to be a NSCLS on biopsy

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Fig. 8: CT Chest, fast tract from CXR in fig. 7, showing a 2 cm right upper lobe nodule which was proven to be a NSCLS on biopsy.

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Conclusion

Conclusion:

The new pathway led to a significant reduction in the unnecessary referral to the lung cancer clinic through better patient selection. There was earlier diagnosis of the cancers and further management could be agreed upon sooner. There was better utilisation of the MDT meetings and clinic appointments. There was a significant number of CT scans deemed unnecessary, however, due to the poor prognosis of lung cancer, a high index of suspicion does need to be employed. The pathway meant that their journey to having a 'no cancer diagnosis' was less complicated, shorter and therefore less stressful.

Consideration:

Comparison needs to be made with the previous pathway in order to evaluate the impact of this new pathway has had on the patient journey/experience and on the types/number of patients discussed at the MDTs.

The impact on the stage of lung cancer at diagnosis and the time to treatment will also need to be evaluated to fully appreciate the impact of this new pathway and identify other modifiable areas.

If more CTs are done there is the risk of increased radiation exposure, cost implications to the trust and patient anxiety while awaiting the scan. However, one can argue the reasons behind the justification of cases where CT showed benign findings

In order to reduce the number of unnecessary fast track CT chest scans the feasibility of a chest radiologist vetting all fast-tracked referred CXRs prior to CT scan can be explored as a possibility resources allowing.
References


