

Optimal Timing of CT Scanning in the Rapid Access Lung Cancer Clinic

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Abstract

Aims

To investigate whether a 'CT first' approach to Rapid Access Lung Cancer Clinic (RALC) review could be feasible in an Irish context.

Methods

A retrospective review of our institution's Lung Cancer Database was performed. All RALC first attendances from 2012-2018 were identified. Timing of CT was assessed as well as CT imaging findings.

Results

Total first attendances in this period were 2372, of whom 91% had CT thorax as part of their evaluation. 866 patients (37%) were diagnosed with lung cancer, all had an abnormal CT. 1290 patients (54%) underwent CT but did not have lung cancer after clinical work up. 34% of patients diagnosed with Lung Cancer had their CT scan post RALC. Time to diagnosis was longer in those who had post RALC CT (34.5 versus 21 days)

Conclusion

CT scanning plays a vital role in the RALC pathway. Initial delays in obtaining CT can result in delayed time to diagnosis. These findings warrant close consideration when devising future national lung cancer policy.

Introduction

Lung cancer is the leading cause of cancer deaths in Ireland, representing approximately 20% of all cancer mortality¹. Lung cancer kills more Irish people every year than breast and colon cancer combined and, despite recent advances, the prognosis is poor with a one-year survival of 37% and a 5-year survival of 13%^{2,3}. This is largely because the disease presents at a late stage, with two thirds of new lung cancer cases in Ireland diagnosed at stage III or greater⁴. Since the introduction of the National Cancer Control Programme (NCCP) and centralisation of cancer services in eight sites nationwide, there has been a doubling in five-year survival rates in patients treated in those centres as opposed to those treated in non-dedicated sites⁵. However, delays in diagnosis, staging and commencing treatment still play a role in the poor outcomes for patients with lung cancer^{6,7}.

Rapid Access Lung Clinics (RALC) were established by the NCCP in 2009 to improve the standard of care for lung cancer in Ireland. The aim of the RALC is to provide access to respiratory specialists as well as rapid diagnostics and to expedite the assessment of patients with clinical suspicion for lung cancer. The current indications for referral to the RALC are

abnormal chest x-ray suggestive of lung cancer or red flag respiratory symptoms, such as haemoptysis. Most patients are referred by their general practitioner (GP). A central Key Performance Indicator for the RALC is that all patients referred are seen within 10 working days and the most recent data from the NCCP suggests that 99% of patients are seen within 15 working days⁸.

Though referral to RALC expedites time to patient review, time to subsequent diagnosis and treatment are often prolonged as patients await investigations such as CT Thorax which is mandatory in lung cancer diagnosis. We have previously found that approximately 1 in 3 patients attending the RALC are diagnosed with lung cancer and, while many of the remainder have other lung conditions or nodules that require surveillance⁹, these patients do not require urgent review within the RALC timeframe. The proportion of patients that undergo CT imaging who are seen in RALC nationally is not known, though it is likely to be high.

The National Optimal Lung Cancer Pathway (NOLCP) in the NHS published by the Lung Clinical Expert group in 2017 suggests that if a patient has an abnormal chest x-ray or high clinical suspicion of lung cancer from their GP, the maximum wait to CT Thorax should be 3 days¹⁰. Some NHS initiatives such as the RAPID (Rapid Access to Pulmonary Investigation) programme, have prioritised next day access to CT scanning and have reduced time from GP referral to clinic review with a fully reported scan to just 4 days. This has helped to almost eliminate delayed diagnosis and improve 14 day and 21 day multidisciplinary team (MDT) discussion targets by 44% and 72% respectively¹¹. Time to assessment in the RALC in Ireland is broadly in line with NCCP guidelines⁸ but timely access to a reported CT Thorax and its impact on time to diagnosis and completed staging, essential for MDT decision making, has not been evaluated.

We investigated the impact of timing of CT scan following referral to the RALC on time to diagnosis for patients with lung cancer and whether a 'CT first' approach to RALC review should be the aim for all appropriately referred patients.

Methods

The standard referral pathway for RALC patients to CT is that an order is placed by the respiratory physician after the patient has undergone assessment in the RALC. In cases where the referral is considered particularly high risk (i.e. definite mass on CXR) the CT is ordered following review of the RALC referral and prior to RALC assessment. A number of dedicated CT slots are available to the coordinator who receives the referral. The aim is for patients to be seen in the RALC within 10 days of referral, in keeping with NCCP guidelines, and this is regardless of whether or not CT has already been obtained. The CT protocol that is used is a contrast enhanced scan of the thorax to the level of the adrenal glands, 1mm soft tissue and lung windows with axial MIP(Maximal Intensity Projection)of lung windows, sagittal and coronal bone windows.

Following institutional ethics approval, we conducted a retrospective review of the Beaumont Hospital Lung Cancer Database. We identified the total number of lung cancer cases diagnosed in our institution from 1st January 2012 to 31st May 2018 and identified those patients that were assessed and diagnosed through the RALC. All patients who attended the RALC for the first time from 1st January 2012 to 31st May 2018 were eligible for inclusion into our study. Patients were excluded if they did not attend their appointment for first RALC review, if insufficient data was available, or if no radiological investigations were performed.

We divided patients diagnosed with lung cancer through the RALC into two groups, those who had a CT prior to clinic review and those who had a CT performed after clinic review to identify the effect this had on timeliness to diagnosis following receipt of GP referral. We used median time to diagnosis rather than mean to mitigate the high number of outliers evident in the cohort and provide a more accurate central tendency. For patients not diagnosed with lung cancer we subdivided their pathologies into the following categories (i)Other cancers (non-lung), (ii)Pulmonary nodule, (iii)Infectious/Inflammatory (including Bronchiectasis), (iv)Interstitial lung disease, (v)other abnormalities and (vi)Normal CT scan. In addition to the Beaumont Hospital Lung Cancer database we used the HSE National Integrated Medical Imaging System (NIMIS) and the Patient Information Profile Explorer (PIPE) to cross reference the data.

The rate of lung cancer tissue diagnosis in our institution is approximately 75%. Pathologic diagnosis was not pursued in cases of multiple co-morbidities, frailty and according to patient preference and in these cases a clinical diagnosis was made. The median time from CT scanning to histological sampling was 2 calendar days for patients who had a CT prior to RALC and 8 calendar days for patients who had a CT scan post RALC.

Results

Lung Cancer Diagnoses

2,372 patients attended the RALC for the first time between 1st Jan 2012 to 31st May 2018. 866 patients were diagnosed with lung cancer, representing an overall lung cancer case detection rate of 37%. Patients diagnosed through the RALC represented 57% of the total of 1,514 patients who were diagnosed with lung cancer and discussed at Beaumont Hospital MDT over this period (table 1). The remaining 648 patients did not come through the RALC but through other pathways, 15% were emergency department presentations, and 35% were from outside hospitals in one year during the time period studied.

All patients diagnosed with lung cancer underwent a CT Thorax except for one patient in whom it was discovered on post-mortem following unexpected death prior to imaging (Table 1). This highlights the importance of CT Thorax imaging in establishing lung cancer diagnosis. Overall, 1,290 patients or 54% of all clinic attendees underwent CT scanning but were found not to have lung cancer after clinical workup. Only 216 (9.1%) of new referrals to the RALC did not undergo CT thorax in a NIMIS connected institution following initial evaluation. 193 (90.6%) of these had a Chest X-ray only and insufficient information was available in the remaining 23 patients. The median waiting time from RALC to CT scan was 8 calendar days. Reasons patients did not have a CT performed were for clinical reasons, such as frailty, and where a CT would have been inappropriate or was not indicated on the basis of CXR findings or symptoms. All patients who had imaging carried out in other institutions had their CT imaging uploaded onto our system prior to clinic and multidisciplinary team review.

We reviewed the initial CT scan reports in all patients diagnosed with lung cancer (table 1). All were identified as abnormal by the reporting radiologist; in 94% the reporting radiologist suggested lung cancer as the primary differential. In the remainder, other abnormalities were described that subsequently turned out to be a lung malignancy after further investigation (6%) (Figure 1). In this 6%, 'cancer' was not mentioned in the differential of the radiology report. A variety of other abnormalities were described which included pleural effusion without evidence of a primary mass, non-resolving consolidation and atelectasis.

In comparison, 18% of patients subsequently diagnosed with lung cancer had a normal chest X-ray at time of presentation to RALC. This is similar to previous retrospective data published in the UK¹². The impact of timing of the initial CT scan on time to diagnosis following referral is shown in Table 2.

Table 1: CT findings in Lung Cancer Cases (N=1514).

	N	(%)
Total Lung Cancer Diagnoses	1514	
RALC	866	57.2
Other Pathway	648	42.8
No CT Performed	1	0.01
CT Performed	1513	99.9
Abnormal CT	1513	99.9
CT Suggestive of Cancer	1427	94
CT Other Abnormality – subsequently cancer	86	6

Table 2: Impact of obtaining CT scan pre-clinic on time to diagnosis.

	No.	(%)	Median Time to Diagnosis from Referral (Days)
CT Pre RALC	569	65.7	21
CT Post RALC	295	34.1	34.5
Unknown	2	0.2	

Non-Lung Cancer Diagnoses

Of the 2372 patients that attended the RALC during this period, 1506 were found not to have lung cancer. 1290 (86%) of these underwent CT evaluation, 193 had chest x-ray only and no radiology was available in 23 patients. The outcomes of patients who underwent CT evaluation is provided in Table 3. 450 patients (35%) had a nodule on CT scan and of these, 371 patients (82%) entered a nodule surveillance programme that required further CT surveillance, emphasising the workload that nodule follow up now requires in modern lung cancer services. Infectious and inflammatory changes, including bronchiectasis, were the next highest finding on scan (364 patients, 28.2%). A further 10% had features of new Interstitial Lung Disease that required follow-up (125 patients, 9.7%). 135 patients (10.5%) had other cancers, these included metastatic breast, melanoma and colorectal cancers as well as other thoracic malignancies such as thymoma. Importantly, only 7% of the entire RALC population had a normal CT scan highlighting both the appropriateness and sensitivity of CT Thorax as a diagnostic tool in in this patient cohort.

Table 3: CT findings in Non-Lung Cancer Cases (N=1290).

	No.	(%)
Other Cancers (Non-Lung)	135	10.5
Pulmonary Nodule	450	34.9
<i>Surveillance recommended</i>	371	28.8
<i>No Surveillance</i>	79	6.1
Infective/Inflammatory/Bronchiectasis	364	28.2
Interstitial Lung Disease	125	9.7
Other Abnormalities	63	4.9
Normal CT	153	11.8

Discussion

The results of this study highlight the importance of CT imaging in the rapid access lung clinic pathway, where it is essential in the identification of cancer from non-cancer pathology, as well as its role in tumour staging and biopsy planning. In our centre, one of eight nationally, every patient diagnosed with lung cancer underwent a CT Thorax as part of their evaluation and it was always abnormal in lung cancer cases. The fundamental role of CT highlights the benefit of obtaining a study as early as possible in the diagnostic process. While this is a retrospective study of one clinical site, our findings demonstrate that initial delays in obtaining CT imaging can result in significant delays in overall time to diagnosis and thus lead to delays in treatment initiation. Our service, like others in Ireland, endeavours to acquire CT imaging prior to clinic review to avoid unnecessary delays, however in our experience this is occurring on an ad-hoc basis rather than as part of a national strategy.

NHS initiatives such as the NOLCP and RAPID programme which prioritise early CT scanning and dedicated physician-led triage of GP referrals have eliminated 31-day diagnosis breaches as recommended by the NHS cancer plan for England¹³ and resulted in a shortened diagnostic timeframe of 15 days in some institutions¹⁴. A process similar to that used in the NOPLC where CT same day/within 72 hours is arranged via the reporting radiologist in cases of abnormal CXR, could be followed in this jurisdiction. Adoption of a similar system in Ireland would reduce time to diagnosis, reduce the number of unnecessary clinic appointments and would help to streamline rapid access services. Our experience would suggest that the agreed referral criteria to a RALC are a good "gate-keeper", and as long as they are adhered to, should not result in significant increased in CT demand but rather a shift in the timing of required CTs. In addition, of the patients who were seen in the RALC only 7% of CT scans were normal, highlighting the role of the RALC in case finding other respiratory conditions and non-lung cancer malignancies. A rapid triage and CT evaluation system would also allow re-direction of some of the high volume of non-cancer pathology seen in this study to other specialist services more suited to patients needs than a cancer dedicated clinic.

Lung cancer screening has been shown to increase the number of early stage cases detected and reduce mortality in lung cancer^{16,17}. Concerns about efficiency and cost effectiveness of screening, particularly in resource limited settings has prevented their wholesale adoption but is likely to play a major role in future lung cancer care. Through low dose CT scanning in high risk populations, a RALC system that is designed around triaging early CT referrals rather than chest x-ray is therefore likely to complement and improve the efficiency of such programmes if implemented in Ireland¹⁵.

Our retrospective study accounts for only one of the NCCP centres in Ireland and a similar audit of the other centres may be necessary to validate our results. However, these findings, coupled with the improvements seen in other jurisdictions with the adoption of rapid CT evaluation warrant close consideration when devising future national lung cancer policy.

Declaration of Conflicts of Interest:

The authors have no conflicts of interest to disclose.

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