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The Impact of Diagnostic Imaging Wait Times on the Prognosis of Lung Cancer

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Abstract

Objective: This study was performed to determine whether gaps in patient flow from initial lung imaging to computed tomography (CT) guided lung biopsy in patients with non–small cell lung cancer (NSCLC) was associated with a change in tumour size, stage, and thus prognosis.
Methods: All patients who had a CT-guided lung biopsy in 2009 (phase I) and in 2011 (phase II) with a pathologic diagnosis of primary lung cancer (NSCLC) at Eastern Health, Newfoundland, were identified. Dates of initial abnormal imaging, confirmatory CT (if performed), and CT-guided biopsy were recorded, along with tumour size and resulting T stage at each time point. In 2010, wait times for diagnostic imaging at Eastern Health were reduced. The stage and prognosis of NSCLC in 2009 was compared with 2011.
Results: In phase 1, there was a statistically significant increase in tumour size (mean difference, 0.67 cm; $P < .0001$) and stage ($P < .0001$) from initial image to biopsy. There was a moderate correlation between the time (in days) between the images and change in size ($r = 0.33$, $P = .008$) or stage ($r = 0.26$, $P = .036$). In phase II, the median wait time from initial imaging to confirmatory CT was reduced to 7.5 days (from 19 days). At this reduced wait time, there was no statistically significant increase in tumour size (mean difference, 0.02; $P > .05$) or stage ($P > .05$) from initial imaging to confirmatory CT.
Conclusions: Delays in patient flow through diagnostic imaging resulted in an increase in tumour size and stage, with a negative impact on prognosis of NSCLC. This information contributed to the hiring of additional CT technologists and extended CT hours to decrease the wait time for diagnostic imaging. With reduced wait times, the prognosis of NSCLC was not adversely impacted as patients navigated through diagnostic imaging.

Résumé

Objectif : Cette étude a été effectuée afin de déterminer si les problèmes d'acheminement des patients entre l'examen d'imagerie initial des poumons et la biopsie guidée par tomodensitométrie (TDM) chez les patients atteints d'un cancer du poumon non à petites cellules étaient associés à une modification du stade tumoral et, par conséquent, à des effets sur le pronostic.
Méthodologie : On a identifié tous les patients ayant subi une biopsie pulmonaire guidée par TDM en 2009 (phase I) et en 2011 (phase II) qui avaient reçu un diagnostic de cancer du poumon primitif (CPNPC) à l'établissement Eastern Health (Terre-Neuve). Les dates des premiers examens d'imagerie aux résultats anormaux, les TDM de confirmation (s'il y a lieu) et les biopsies guidées par TDM ont été consignées, de même que la taille des tumeurs et le stade tumoral correspondant à chacune de ces dates. En 2010, on a réduit le temps d'attente en imagerie diagnostique à l'établissement Eastern Health. Le stade et le pronostic des CPNPC en 2009 ont été comparés à ceux de 2011.
Résultats : Au cours de la phase 1, on a observé une augmentation statistiquement significative de la taille des tumeurs (différence moyenne de 0,67 cm; $P < 0{,}0001$) et du stade ($P < 0{,}0001$) entre l'examen d'imagerie initial et la biopsie. On a constaté une corrélation modérée entre le temps écoulé (en jours) entre les examens, d'une part, et la variation de la taille de la tumeur ($r = 0{,}33$, $P = 0{,}008$) ou le stade de la maladie ($r = 0{,}26$, $P = 0{,}036$), d'autre part. Au cours de la phase II, le temps d'attente médian entre l'examen d'imagerie initial et la TDM de confirmation a été réduit de 7,5 jours (par rapport à 19 jours). Cette réduction du temps d'attente a permis de constater une augmentation statistiquement significative de la taille des tumeurs (différence moyenne de 0,02 cm; $P > 0{,}05$) ou du stade ($P > 0{,}05$) entre l'examen d'imagerie initial et la TDM de confirmation.

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Conclusions : Les retards dans l'acheminement des patients en imagerie diagnostique ont entraîné une augmentation de la taille des tumeurs et un avancement du stade de la maladie, ce qui a des répercussions néfastes sur le pronostic des personnes atteintes d'un CPNPC. À la lumière de ces renseignements, on a embauché d'autres technologues spécialisés en TDM et on a prolongé les périodes où les TDM sont effectuées, afin de réduire le temps d'attente pour subir des examens d'imagerie diagnostique. La réduction du temps d'attente a permis de ne pas aggraver le pronostic dans les cas de CPNPC tandis que les patients étaient acheminés en imagerie diagnostique.

Key Words: Non–small cell lung cancer; Radiology; Wait time; Prognosis

The assessment and the management of wait times in cancer care are important clinical, social, and political issues [1]. There are significant efforts to monitor and improve cancer wait times in Canada [2]. Studies that examine wait times attempt to identify delays and bottlenecks in cancer care, and may aid in the development of targeted solutions [3]. Despite advances in diagnostic and therapeutic strategies in recent years, lung cancer remains one of the leading causes of morbidity and mortality in the developed world [4]. Non–small cell lung cancer (NSCLC) represents approximately 80% of lung cancer diagnoses and has a 5-year overall survival rate of approximately 15%. The stage at which NSCLC is diagnosed has a significant impact on anticipated 5-year survival [4]. Unlike other solid tumours (with survival rates of 60%-90% at 5 years), the survival rates for lung cancer have not been improving [1]. It is important to consider what factors may contribute to these poor outcomes. Factors that affect the prognosis of lung cancer are stage, histology, age, sex, comorbidities, and time interval between first symptom and treatment [5]. Of these risk factors, the time interval between symptoms and treatment is potentially modifiable.

The concept of ''wait times'' has been more extensively explored for breast and colorectal cancers, but studies of this type that focus on lung cancer in diagnostic imaging are less common. One large-scale systematic review by Olsson et al [6] in 2009 addressed this issue and concluded that wait times are often longer than recommended, but it is unclear if this has an impact on outcome. Some studies that have been performed have primarily focused on the timing of referrals and treatments, not on the potential delays that occur during the diagnostic imaging period [7–9]. In January 2013, the Canadian Association of Radiologists published a set of maximal wait times for computed tomography (CT) and magnetic resonance imaging (MRI) [10]. This set of recommendations is a valuable reference for Canadian institutions that perform their own clinical audit. This study will focus on diagnostic imaging wait times. The objective of this study was to examine the impact, if any, of the time periods between steps in the diagnostic pathway within the imaging department, on tumour growth and stage.

Materials and Methods

This was a retrospective cohort study designed as a clinical audit. It was conducted with patients at Eastern Health who underwent a CT-guided lung biopsy from January to December 2009 (phase I) and January to December 2011 (phase II) with the pathologic diagnosis of NSCLC. The hiring of new CT technologists and extended hours (from 8-16 hours daily) contributed to a reduction in wait time between phase I and phase II. The biopsies were performed at one of the Memorial University affiliated tertiary care centers at Eastern Health (either the Health Sciences Center or St. Clare's Hospital), both in St. John's, Newfoundland. For each member of this cohort, data were collected to identify the dates of diagnostic imaging that led to the diagnosis of NSCLC. From these dates, wait times were calculated.

Patient demographics, imaging, and disease characteristics were abstracted from both PACS (picture archiving and communication system) and the Eastern Health MediTech system. The baseline characteristics collected include age and sex. Images were obtained by using Lightspeed VCT, 64-slice CT scanner (General Electric, Milwaukee, WI). Images were viewed on lung (1500 HU, −600 HU) and mediastinal (400 HU, 50 HU) windows. The lung mass was measured according to the TMN staging guidelines [4]. By using PACS and MediTech, the dates extracted included the following: (i) date of first abnormal chest imaging (usually either a chest radiograph or CT), (ii) date of follow-up chest CT to confirm that a lung mass is present (if needed), and (iii) the date that a CT-guided lung biopsy was performed that led to the pathologic diagnosis of NSCLC. The number of days between each date was calculated as the wait time. The measurement was staged according to the T stage of the 2009 TMN classification system [4]. Tumour size and stage were outcomes in the analysis.

The inclusion criteria were subjects who underwent a CT-guided lung biopsy during the study time frame. Both sexes and all ages were included. Subjects were excluded if the pathologic diagnosis was anything other than NSCLC. In cases in which an interim CT was not required, such cases were not considered in the analyses that looked at wait time from the first image to CT. In cases in which the biopsy result was inconclusive and a repeated CT-guided lung biopsy had to be performed, the date of the biopsy that produced the diagnostic sample was the date recorded for study purposes (a missed biopsy is a source of delay).

Ethical Consideration

The data were collected from MediTech and PACS. The patient identifiers were removed once the data were collected