



# The 3rd Annual Ontario Thoracic Cancer Conference at Niagara-on-the-Lake

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## KEY WORDS

Thoracic cancer, lung cancer, Ontario, conference

## 1. INTRODUCTION

The 3rd Annual Ontario Thoracic Cancer Conference was held March 28–30, 2008, in Niagara-on-the-Lake, bringing together those in community and academic practice throughout the province who have an interest in thoracic oncology. More than 150 attendees participated this year, twice as many as participated at the inaugural meeting. For the first time, abstracts from trainees were submitted, and those abstracts are published here. The selected highlights that follow underscore the breadth of the work ongoing in Ontario to combat the challenge of lung and other thoracic cancers.

## 2. HIGHLIGHTS

### 2.1 Technological Innovations in Radiation Medicine

The first day's keynote speaker, Dr. David Jaffray [Princess Margaret Hospital (PMH)], has been at the forefront of developments in cone-beam computed tomography (CBCT) that have enabled a new era in image-guided radiation therapy (IGRT)<sup>1,2</sup>. Devices for CBCT are now mounted on linear accelerators used for radiation therapy and provide three-dimensional volumetric imaging that permits greater accuracy and precision in identifying tumour position and in delivering treatment. Cone-beam computed tomography may also allow for an assessment of the treatment response of peripheral lung tumours, an important step in the development of adaptive radiation therapy that seeks to modify aspects of treatment according to response—for example, to increase the likelihood of response or to reduce normal-tissue toxicity<sup>3</sup>.

Dr. Jaffray presented an overview of advances in radiation therapy for lung tumours. He discussed methods

for overcoming the uncertainty in tumour location associated with respiratory motion during treatment, and he articulated the importance of taking this motion into account during the treatment planning process. Accounting for motion is now commonly achieved with the use of “four-dimensional” computed tomography (4DCT) imaging, a process that sorts CT images into “bins” that correspond to various phases of the respiratory cycle. By combining images from the various phases (for example, inhale and exhale), tumour excursion can be approximated and included in the treatment volume. Currently, 4DCT and CBCT are both playing an important role in radioablative stereotactic lung radiation therapy, an emerging treatment option for certain lung tumours<sup>4</sup>.

### 2.2 Evaluation of the Mediastinum in Lung Cancer

Accurate evaluation of nodal involvement in the mediastinum is a critical issue in thoracic oncology. Drs. Lisa Ehrlich (Sunnybrook Health Sciences Centre), Kam Soghrati [The Scarborough Hospital (TSH)], and Abdollah Behzadi (TSH) addressed the multimodal evaluation of the mediastinum. They covered the role of positron-emission tomography (PET)–CT imaging, the emerging option of endobronchial ultrasound (EBUS) fine-needle aspiration cytology (FNAC), and mediastinoscopy<sup>5</sup>. They noted that mediastinoscopy, like EBUS, can be performed as a day-case procedure, and that it may also offer additional information to the surgeon about potential eligibility for trimodality therapy in cases of suspected mediastinal involvement. Mediastinoscopy has resolutely remained the “gold standard” despite a number of innovations in mediastinal assessment, but for how much longer that leading position will be maintained remains to be seen. Currently, several centres in Ontario are either offering or considering EBUS. As with mediastinoscopy, EBUS is subject to operator dependency, and it further requires close cooperation with the cytopathology team to realize its potential. When EBUS is combined with endoscopic

ultrasound (EUS) FNAC, a more complete mediastinal assessment is possible, and EUS FNAC can also assess some potential sites of metastatic disease as well<sup>6</sup>. As with any sampling technique, the potential for false negative results with FNAC should be borne in mind. Attendees heard how individual centers are taking steps to satisfy themselves that, in their hands, EBUS can deliver results comparable to those with mediastinoscopy.

The indications for <sup>18</sup>Fluorodeoxyglucose (FDG) PET-CT imaging are increasing<sup>7</sup>. Currently, this imaging modality can be accessed in the province of Ontario through a combination of specified indications (PET registry studies), case-by-case application (through the PET Access Program), and clinical trials. Noninvasive PET is useful in evaluating the mediastinum, but there are potential pitfalls. Causes of false positive and false negative PET scans were reviewed, and attendees were reminded that, in certain circumstances—for example when the primary lung cancer has low FDG uptake—further investigation of a PET-negative mediastinum should be considered<sup>8</sup>. As technologies develop and patient access to them increases, it seems likely that mediastinal assessment in thoracic cancers will be achieved through a combination of noninvasive and invasive approaches.

### 2.3 Setting Thoracic Surgical Standards in the Province of Ontario

In a session that generated much discussion, the challenge of redesigning provincial thoracic surgery services was tackled by Drs. Sudir Sundaresan (The Ottawa General Hospital) and A. John Dickie (Peterborough Regional Health Centre). They reviewed the setting of thoracic surgery standards by Cancer Care Ontario (CCO) to distinguish level I from level II surgical centers<sup>9,10</sup> and highlighted the many stakeholders in such a large-scale service redesign. The issue promises to be an emotive one, but there was broad support at the meeting for the setting of thoracic surgical standards so as to benefit patients and ultimately improve outcomes. The stakeholders range from local communities, some of which are geographically quite isolated and currently receive care from a community thoracic surgeon, to hospitals that gain both tangibly and intangibly from having a thoracic surgery service, to surgeons themselves.

The CCO standards were developed in response to the question “What is the optimum organization for the delivery of cancer-related thoracic surgery in Ontario,” but as was pointed out, oncology is only one part of the thoracic surgeon’s practice. The potential effects of a service redesign of this kind on cancer and non-cancer services alike will require close attention. It was suggested during the discussion that, if significant redesign is undertaken, careful planning and a means of prospectively evaluating the effects should be built into the process.

### 2.4 Lung Cancer Patterns of Care

Given his longstanding interest in cancer service delivery, patterns of care, and outcomes, Dr. William Mackillop (Queen’s University) delivered a thought-provoking and somewhat sobering review of variations in the management and outcome of non-small-cell lung cancer (NSCLC) in Ontario<sup>11</sup>. Drawing on many years’ experience with the use of multisource population databases, he reviewed the development of such tools and described how they are being used. He presented data demonstrating that, although the outlook for selected patients may be improving, the overall outcome of all patients with NSCLC has been little affected. Whether more recent data incorporating the rise in delivery of adjuvant chemotherapy for resected early-stage lung cancer and other therapeutics will change this finding remains to be seen<sup>12</sup>. In pursuing maximization of outcomes for lung cancer patients on a province-wide scale, it seems that regional variation in therapy utilization and access to services needs to be better understood and explicitly considered in health care initiatives.

### 2.5 Contributions of the National Cancer Institute of Canada Clinical Trials Group

Dr. Frances Shepherd (PMH), chair of the Lung Site of the National Cancer Institute of Canada (NCIC) Clinical Trials Group (CTG), described the significant impact made by that group on the international stage. Pivotal trials affecting lung cancer treatment were reviewed, including these studies:

- BR 6—In patients with limited-stage small-cell lung cancer receiving chemotherapy and radiation, early integration of thoracic radiation, as compared with late or consolidative radiation, resulted in better progression-free and overall survival<sup>13</sup>.
- BR 10—In patients with completely resected, early-stage NSCLC, adjuvant vinorelbine and cisplatin, as compared with observation, prolonged disease-free and overall survival<sup>14</sup>.
- BR 21—In patients with advanced NSCLC who progressed after 1 or 2 lines of prior chemotherapy, use of the epidermal growth factor receptor inhibitor erlotinib, as compared with placebo, resulted in better survival<sup>15</sup>.

The NCIC CTG continues to play a major role in national and international cooperative lung cancer studies. In doing so, it draws on an array of Canadian talent, including the expertise that exists within Ontario in such areas as molecular medicine, therapeutics, and quality-of-life and economic assessment.

Additional debate on the role of trimodality therapy in selected patients with stage IIIA, non-bulky N2 disease {Drs. Gail Darling (Toronto General Hospital) and Gordon Okawara [Juravinski Cancer Centre (JCC)]<sup>16–19</sup>,

discussion of the ethics of expensive cancer therapies [Dr. Scott Berry (Odette Cancer Centre)]<sup>20</sup>, and exploration of the role of the advanced practice nurse in lung cancer [Ms. Lorraine Martelli-Reid (JCC)]<sup>21</sup> made for a conference program that was both contemporary and practical. It was rounded out by the presentation of the top two scientific abstracts of the conference [Drs. Jason Correia (McMaster University) and Gerald Lim (PMH)], which were all subject to review by a panel of judges.

### 3. SUMMARY

It is hoped that, in future years, the conference will continue to grow and become an effective tool for fostering multidisciplinary, multicentre collaboration and for improving the outcome for lung cancer patients throughout the province of Ontario.

Many thanks to all those who made this meeting a success, including sponsors who provided unrestricted educational grants: Eli Lilly, Astra Zeneca, and Sanofi-Aventis.

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## A B S T R A C T S

### Improving Outcomes for Early-Stage Non-Small-Cell Lung Cancer with Stereotactic Body Radiation Therapy

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**Background and Objectives:** About 20% of patients have early-stage non-small-cell lung cancer (NSCLC). Medically inoperable patients may receive radical radiation therapy (RT). Conventional RT outcomes are far inferior to surgery. Delivered in only a few fractions, stereotactic body radiation therapy (SBRT) gives ablative doses of RT that are expected to provide high rates of local control.

**Methods:** Patients with medically inoperable T1-2N0M0 NSCLC are treated on Research Ethics Board-approved SBRT protocols. Patients lie in customized body moulds to minimize movement, and respiratory-synchronized computed tomography (CT) scans for treatment planning identify tumour position and motion. Multiple beams shape the radiation dose to the target. Image guidance by CT before and during treatment verifies patient and target position to 3 mm or less. Positron-emission tomography (PET) is used for staging and response assessment.

**Results:** In 76 patients (median age: 73 years) with 82 lesions (median size: 2.3 cm), median follow-up is 8 months. In 49 patients (53 lesions), follow-up is 6 months or more (median: 13 months). In the latter group, 2 lesions (4%) have failed locally, 11 patients (22%) have metastases (median: 9 months), and 9 patients (18%) have died (median: 11 months). Overall, the 3-month radiologic response rate is 56% (39 of 69 lesions). The most common acute (within 3-months) toxicities are grades 1 or 2 fatigue (41%), cough (21%), skin erythema (14%), and chest wall pain (8%); late toxicities include grades 1 or 2 chest wall pain (23%), grades 1 through 3 rib fracture (14%), and grades 1 or 2 atelectasis (9%). Four grade 3 events have occurred (3 rib fractures, 1 pneumonitis).

**Conclusions:** Treatment with SBRT is promising and well tolerated. Local control is high. Long-term data will define efficacy. Clinical indications are evolving; patients with oligometastatic NSCLC and pulmonary metastases may benefit from SBRT.

### Outcomes for Cervical Mediastinoscopy in a Community Teaching Hospital

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**Background:** Cervical mediastinoscopy (CM) has been considered the “gold standard” for pathology assessment of mediastinal abnormalities. In view of the development of less invasive technologies for mediastinal evaluation and their dissemination to community hospital settings, we sought to determine the outcomes for CM in a community hospital by examining the complication and false negative rates of this procedure as a benchmark for future comparisons.

**Methods:** We performed a retrospective chart review of 150 consecutive patients who underwent CM between January 2004 and December 2006 (inclusive). Demographics of the patients and the complications and results of the procedures performed were evaluated. In lung cancer patients who subsequently underwent thoracotomy, the false negative rate for CM was calculated.

**Results:** Median age of the patients was 69 years, and 52% were men. Pathology included lung cancer ( $n = 105$ ), metastatic disease ( $n = 6$ ), lymphoma ( $n = 8$ ), and benign diseases ( $n = 31$ ). Postoperative complication rate was 2.7%. No postoperative deaths occurred. Of 56 patients with negative mediastinoscopy who underwent thoracotomy, 2 were later found to harbour positive N2 nodes in lymph node stations accessible by CM, for a false negative rate of 3.57%. Perioperative imaging of all false-positive CM cases were negative for evidence of N2 involvement.

**Conclusions:** In this cohort of patients, CM was associated with no mortalities and low rates of postoperative complications and false-negative diagnostic imaging. The less-invasive endoscopic and radiologic technologies for mediastinal assessment should at least have the same false negative rates and lower complication rates if they are to replace CM in the community hospital setting.



### Video-Assisted Thoracoscopic Surgery Lobectomy for Lung Cancer: Prospective Data on Initial Experience at a Canadian Community Hospital

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**Background and Objectives:** Advantages of video-assisted thoracoscopic surgery (VATS) lobectomy, as compared with lobectomy by conventional thoracotomy, include shorter hospital stay and reduced postoperative pain. We examined the preliminary experience with VATS lobectomy in a community hospital.

**Methods:** Data were prospectively collected on all patients that underwent VATS lobectomy by a single surgeon at the St. Catharines General Hospital between August 2006 and November 2007. All patients were discharged on a standard narcotic protocol.

**Results:** Lobectomy by VATS was performed in 28 patients [43% men; median age: 67.5 years (range: 45–87 years)]. Preoperative percentage predicted forced expiratory volume in 1 s (FEV<sub>1</sub>) was median 82.0% (range: 54%–120%) and percentage diffusion capacity (DLCO) was median 73.5% (range: 44%–111%).

Pathology revealed that 82.1% ( $n = 23$ ) of patients had primary non-small-cell lung cancer (NSCLC) stage IA (39.1%), stage IB (43.5%), stage IIA (4.3%), stage IIB (8.7%), and stage IIB (4.3%). Other pathology included metastatic colorectal adenocarcinoma ( $n = 2$ ), carcinoid ( $n = 1$ ), hamartoma ( $n = 1$ ), and pseudotumour ( $n = 1$ ). All patients had complete resection with negative margins on pathology exam.

Two conversions to open thoracotomy for bleeding control occurred (conversion rate: 7.1%). Median postoperative chest-tube days were 4 (range: 2–13 days). Length of hospital stay was median 5.5 days (range: 3–44 days). No deaths were reported at 30-days of follow-up.

**Discussion and Conclusions:** Lobectomy by VATS for lung cancer can be performed safely in a community hospital with acceptable morbidity and mortality. Lobectomy by VATS is a feasible alternative to conventional thoracotomy in the management of lung cancer.

### The Long Journey of Lung Cancer Patients to Treatment

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**Background and Objectives:** Treatment recommendations for lung cancer patients require accurate staging and multidisciplinary assessment. Our aim was to assess the delays to treatment decision-making in patients referred to our institution for consideration of radical radiation.

**Methods:** Retrospective chart review of patients referred to the Princess Margaret Hospital Lung Radiation Oncology Group with lung cancer from January 1 to September 30, 2004, documented dates and findings related to the critical steps leading to treatment decision.

**Results:** Among 284 patients referred with presumed non-metastatic disease, the following intervals were documented: chest X-ray (CXR) to initial computed tomography (CT) imaging, median 28 days; and CT imaging to tissue biopsy, median 22 days. In 174 patients (61%), further imaging in our institution to update old chest CT images or because of development of symptoms was needed for completion of metastatic workup. Repeat CT chest showed progression of the primary or lymph nodes in 85 patients (56%; median 70 days from the initial CT), upstaging to incurable disease in 22 patients (13%), and no change in 32 patients (21%). A stage change occurred in 33% of patients after completion of their workup, with most being upstaged to stage IV. After completion of assessment, only 118 patients (41%) were treated radically, at a median of 3.2 months from initial CXR.

**Discussion and Conclusions:** Our review documented extensive delays at multiple steps, adding to more than 3 months from initial CXR to the start of radiotherapy. These time delays were associated with progression of cancer. Expediting multidisciplinary assessment of patients with suspected lung cancer could result in improved outcomes.

### Synergistic Antitumour Effects of Regulatory T-Cell Blockade Combined with Pemetrexed in Murine Malignant Mesothelioma

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**Background/objectives:** CD4<sup>+</sup>CD25<sup>+</sup> regulatory T cells (“Tregs”) can promote the growth of some tumours. We previously showed that the presence of Tregs was associated with poor survival of patients with malignant pleural mesothelioma). The objective of the present study was to determine whether Treg blockade might enhance survival when combined with pemetrexed in established tumours in our intrathoracic murine model of malignant mesothelioma.

**Materials and Methods:** Murine malignant mesothelioma cells (AC29) were injected into the right pleural cavity of CBA mice for tumour development. Four days after the injection, tumour-bearing mice were treated with pemetrexed with or without Treg blockade.

**Results:** The synergistic antitumour effect of Treg blockade and pemetrexed on prolonged survival was associated with increased interleukin 2 and suppressed transforming growth factor  $\beta$ 1 at the local tumour site. Significantly decreased %Treg and increased %CD8<sup>+</sup> cytotoxic T cells were observed in mice treated with the combined protocol, but not in mice treated with pemetrexed alone. The survival benefit was abrogated if anti-CD8 monoclonal antibody was simultaneously administered.

**Conclusions:** Our findings suggest that Treg blockade combined with pemetrexed can suppress mesothelioma growth in established tumour *in vivo* by inducing greater antitumour immune reaction. This study also validates a new intrathoracic tumour model of pleural effusion to explore the role of antitumour immunity in murine malignant mesothelioma.

### Prognostic Factors in Solitary Resected Brain Metastasis from Non-Small-Cell Lung Cancer

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**Background and Objectives:** Reports in the medical literature have described cases of extended survival of patients with stage IV non-small-cell lung cancer (NSCLC) with solitary metastatic disease that have received aggressive management both to the brain metastasis as well as to the local or regional disease. The objective of the present research was therefore to analyze prognostic factors that predict for outcome in this unique patient population.

**Methods:** We performed a single-institution retrospective chart review of 35 NSCLC patients with solitary brain metastasis treated with craniotomy and whole-brain radiotherapy. Of these patients, 8 (22.9%) underwent chest surgery, 24 (68.6%) received chemotherapy, and 14 (40.0%) received thoracic radiation; 13 were otherwise stage I/II (37.1%), and 20 were stage III (57.1%). Mean age at diagnosis was 58.5 years. Brain metastasis <3 cm was present in 18 (56.25%) and >3 cm in 14 (43.75%).

**Results:** Median survival was 7.8 months. At last follow-up, 3 patients (8.6%) were alive and well, 6 (17.1%) were alive with disease, 24 (68.6%) had died of their disease, and 2 (5.7%) had died of other causes. Univariate analysis demonstrated that lung surgery ( $p = 0.0033$ ), primary lung treatment more than 8 weeks after brain surgery ( $p = 0.0128$ ), and stage I/II ( $p = 0.0467$ ) were predictive of overall survival.

**Discussion and Conclusions:** Survival remains poor for stage IV NSCLC patients with a synchronous solitary brain metastasis. However, patients with thoracic disease amenable to local resection should be considered for such therapy, because it may hold a survival advantage for them as compared with patients with more locally-advanced disease.

### Hyperpolarized $^3\text{He}$ Magnetic Resonance Imaging of Radiation Pneumonitis: Initial Findings at 3.0 Tesla

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**Background and Objectives:** Hyperpolarized  $^3\text{He}$  magnetic resonance imaging (HP  $^3\text{He}$  MRI) is a method of functional lung imaging allowing for visualization of ventilation patterns and defects at a high resolution. In this pilot study, we assessed potential  $^3\text{He}$  MRI phenotypes of radiation pneumonitis in lung cancer patients post-radiation.

**Methods:** Subjects were recruited from the London Regional Cancer Program based on post-radiation clinical or radiologic evidence of pneumonitis and spirometric measurement of forced expiratory volume in 1 s. We scanned 4 subjects using HP  $^3\text{He}$  MRI imaging at 3.0 Tesla. Imaging occurred during a 16-s breath-hold of HP  $^3\text{He}$ , using a spin-exchange optical pumping system. The static ventilation images thus acquired enabled analysis of ventilation patterns. A breath-hold-matched proton scan was also acquired to allow for visualization of the thoracic cavity for anatomic comparison.

**Results:** Preliminary results in 4 subjects suggest that numerous changes occur in the ventilation patterns of the lungs of subjects with pneumonitis following radiation therapy. Ventilation defects were found distal to, and in some cases coinciding with, treatment site and radiation pneumonitis location in subjects with radiation pneumonitis resulting from lung cancer treatment. Quantitative analysis of ventilation defect volume and direct comparison to X-ray computed tomography results provide an explanation of the causes of ventilation defects.

**Conclusions and Discussion:**  $^3\text{He}$  MRI is a valuable tool for the visualization of regional damage resulting from pneumonitis post-radiation. Analysis of radiation treatment parameters in conjunction with  $^3\text{He}$  MRI may allow for improved understanding of lung response to radiation.

### An Institutional Review of the Current Medical Chart Documentation Practices for Tobacco Use in Radiation Oncology Patients with Lung or Head-and-Neck Cancer

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**Background:** Smoking during radiation therapy increases the risk of treatment failure and disease recurrence. In fact, complete response rates are significantly lower in patients who continue to smoke during treatment. Despite this, smoking cessation is seldom adequately addressed in tertiary cancer centres.

**Objectives:** To retrospectively review medical chart documentation practices of radiation oncologists for tobacco use in patients with lung or head-and-neck cancer seen in consultation at a tertiary care cancer centre.

**Methods:** The 134 charts examined for current radiation oncology patients consisted of 67 consecutive charts in each of two tumour sites. Charts were reviewed to determine the information documented by physicians on the patients' smoking status and any cessation counselling offered.

**Results:** Overall, information pertaining to smoking status was documented in 104 of 134 (77.6%) cases. Analysis by tumour type showed 79.1% documentation of smoking status in lung cancer and 76.1% in head-and-neck cancer. Smoking status information meeting a predetermined threshold level of adequacy required in patient management was found in 67% of the charts overall. History regarding second-hand smoke exposure was recorded in only 2% of charts. Lack of smoking status documentation occurred more frequently in patients who had been previously seen by medical or surgical oncology (30%) and in cases of treatment with palliative intent (30%). Documented smoking cessation counselling by the oncologist occurred in 1 of 134 cases.

**Conclusions and Discussion:** With only 67% of patient charts in this population containing adequate smoking status information, there appears to be significant room for improvement. Adequate recording of tobacco use status is instrumental as the first step in any effort to prompt cessation counselling in subsequent follow-up visits. Our study emphasizes the need for more attention to smoking cessation efforts in oncology patients.

### Effects of Genistein Following Fractionated Lung Irradiation

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**Introduction:** We hypothesize that inflammatory cytokines and the subsequent production of reactive oxygen species play a key role in radiation-induced lung injury. Previously, we showed that genistein is effective in preventing damage following single doses of radiation. The purpose of the present study was to investigate protection by genistein with fractionated doses of radiation.

**Methods:** C3H/HEJ mice were irradiated with a dose of 9 fractions of 3.1 Gy over 30 days (approximately 10 Gy single dose) after having been maintained on a genistein diet (equivalent to approximately 10 mg/kg) just before the first fraction. Damage was assessed over 28 weeks in cells obtained from the lungs by a cytokinesis block micronucleus (MN) assay and by monitoring changes in breathing rate and histology. Tumour protection was also assessed by colony assay to determine cell survival following *in situ* irradiation.

**Results:** Genistein was found to cause about a 50% reduction in the MN damage observed during the fractionated treatment and to continue to reduce MN formation at later times to background levels by 16 weeks. Genistein also reduced collagen deposition by 30%. A slight protection against increases in breathing rate were noted during weeks 11–18, but not at later times. This protection did not increase overall survival. Using the KHT fibrosarcoma model, we demonstrated no tumour protection by genistein following single and fractionated radiation doses.

**Conclusions:** Our results suggest that genistein can protect lung cells against damage caused by irradiation, but that such protection does not extend to tumour cells growing in the lung.

### Smoking Cessation in Radiation Oncology as the Missing Drug in Clinical Trials—Identifying Patterns of Tobacco Use and Barriers to Cessation in Oncology Patients

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**Background:** Abstinence from tobacco use, especially during treatment, may significantly improve response rates to radiation therapy. The magnitude of this improvement may be greater than that seen with drugs such as radiosensitizers or chemotherapy. Nevertheless, some patients continue to smoke during radiation therapy.

**Objectives:** To perform a qualitative study to examine the tobacco use behaviours and barriers to smoking cessation of patients diagnosed with lung or head-and-neck cancer.

**Methods:** The study accrued 18 patients with a diagnosis of either lung or head-and-neck cancer who were on active radiation therapy at a tertiary care cancer centre. Detailed self-administered questionnaires or structured interviews (or both) were used to gather data regarding smoking behaviours, barriers to cessation, and attitudes toward tobacco use cessation. Input was also obtained from key health care providers.

**Results:** Smoking cessation represented a difficult achievement for most patients, requiring multiple attempts. The most important reason for quitting cited by former smokers was the patient's cancer diagnosis. The most significant patient-perceived barriers to smoking cessation included a belief of being addicted to cigarettes, using cigarettes to "calm nerves," cravings for a cigarette, and fear of losing the enjoyment or pleasure derived from smoking. Overall, patients' perception that smoking is bad for one's health increased after their diagnosis of malignancy. For most patients, self-reported overall quality of life improved or remained the same after quitting. Practitioner-based barriers to tobacco-use cessation counselling primarily included a lack of time in clinical consultation visits.

**Conclusions and Discussion:** Knowledge gained from this study is instrumental for ongoing program development and may contribute to investment in resources for tobacco use cessation efforts in the oncology population.

**Toxicity of an Accelerated Hypofractionated Radiotherapy Regimen for Early-Stage Non-Small-Cell Lung Cancer**

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**Background and Objectives:** To retrospectively review the toxicity profile of an accelerated hypofractionated radiotherapy alone for early-stage non-small-cell lung cancer (NSCLC) in patients treated at a single institution.

**Methods:** A policy at our institution of treating early-stage NSCLC without nodal involvement with an accelerated hypo-fractionated regimen of 4 Gy daily was adopted in 1996. We report here the acute and late side effects associated with that treatment.

**Results:** A total of 124 tumours were treated in 118 patients (56 men, 62 women). The median follow-up from end of treatment to last follow-up or death was 23.2 months. The median age at diagnosis was 74.7 years. Almost all patients (96.6%) were not candidates for surgery because of medical comorbidities or old age. All patients were node-negative, with 75 T1 tumours, 40 T2 tumours, and 9 T3/4 tumours. Most patients were treated with 48 Gy in 12 fractions (59.7%); the remainder were treated to 52 Gy in 13 fractions. The most common acute side effect was dermatitis (19.4%), followed by cough (13.7%), dyspnea (6.5%), esophagitis (4.8%), and chest pain (2.4%). Pneumonitis requiring steroids was reported in 5 patients, with 1 patient dying just 6 weeks after administration of steroids. Four rib fractures in the treatment field were reported. Acute side effects were well tolerated with no toxicity-related delay in completion of treatment.

**Conclusions:** Accelerated hypofractionated radiotherapy with this dose fractionation is well tolerated in patients with early stage NSCLC who are medically inoperable or refuse surgery.

**Evaluation of Lung Tumour Regression with Four-Dimensional Cone Beam Computed Tomography for Adaptive Radiotherapy**

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**Background and Objectives:** With the advent of on-treatment image guidance technology such as cone-beam computed tomography (CT) scanning, radiation oncologists are now better able to define the changing tumour target over the 6- to 7-week course of radical lung cancer treatment. The objective of our project was to use respiratory-correlated cone-beam CT (RCCBT) imaging to study the volumetric, positional, and geometric changes that occur throughout the course of radical radiotherapy in non-small-cell lung cancer (NSCLC) to guide future research into adaptive radiotherapy for lung cancer patients.

**Methods:** Patients with pathology-confirmed NSCLC receiving radical radiotherapy to a dose of 45 Gy or higher with concurrent chemotherapy were included in the study. Serial cone-beam CT images were used to identify and contour the tumour in the exhale phase of respiration on successive weeks after the start of radiotherapy.

**Results:** We evaluated 13 consecutive lung patients for tumour regression. In 8 patients, RCCBT images were of sufficient quality to assess tumour regression. Tumour regression was identifiable in 5 of the 8 patients after 15 fractions and in 7 of the 8 patients after 20 fractions. We observed 19%–54% tumour shrinkage after 20 fractions and 14%–71% tumour shrinkage at the end of treatment.

**Discussion and Conclusions:** Current RCCBT image quality allows for assessment of tumours located more peripherally. In such cases, tumour regression is documented in most patients. The feasibility of adaptive radiotherapy in radical lung cancer treatment should be further investigated.