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Canadian Association of Radiologists: Guide on Computed Tomography Screening for Lung Cancer

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The past several years have seen the publication of the results of several major studies, evaluating the use of low-dose computed tomography (LDCT) scanning in the screening of high-risk individuals for lung cancer. Many major U.S. organizations have issued guidelines in support of performing lung cancer screening in appropriate populations, and organized screening programs are becoming well established in the United States. In Canada, however, there are currently very few documents outlining screening recommendations. Cancer Care Ontario issued a statement on lung cancer screening in 2013 [1] and the Canadian Task Force on Preventive Health Care has just published new guidelines for lung cancer screening [2]. There are pilot projects underway in some provinces, as well as smaller regional centres. There is also growing concern about opportunistic screening being performed outside of organized screening programs. Although this discussion is outside the scope of the document, the Canadian Association of Radiologists (CAR) does recommend that individual provinces undertake a provincial screening program with a provincial registry, respecting the limitations and constraints of provincial budgets.

There are currently a number of guidelines in circulation. While most guidelines agree that LDCT screening only be provided for individuals at high risk for lung cancer, there are slight differences among these guidelines as to the definition of high risk individuals. It is important to recognize that we are in early stages of lung cancer screening in North America, data are still accumulating and there is currently no one definitive guideline. This guide was prepared by a working group of expert advisory members of the CAR, without whom this document would not have been possible. The CAR would also like to acknowledge the many CAR members and external reviewers who contributed to this document. We also received valuable comments from a number of specialty organizations including the following:

- Canadian Association of Medical Radiation Technologists
- Canadian Respiratory Health Professionals/Canadian Thoracic Society
- Canadian Task Force on Preventative Health Care
- Cancer Care Ontario
- College of Family Physicians of Canada

In the absence of any unifying guidelines, the CAR has provided recommendations based on the current literature and evidence-informed expert opinion.

As LDCT scanning is the central tool for lung cancer screening, the radiologist has a crucial role to play in the screening process. This document is intended mainly for use by radiology departments or clinics that intend to undertake a screening program. This involves radiologists, technologists, and support staff who would participate in the enrollment, scanning, interpretation, and follow-up of patients eligible for screening.

Although the primary target of this document is radiologists, it is recognized that screening is a multidisciplinary

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process. As such, family physicians, respirologists, and thoracic surgeons all have roles to play in the screening process and can potentially be impacted by the recommendations of this document. This document may also be useful in assisting administrators and policy makers responsible for making decisions about appropriate use of diagnostic imaging.

These guidelines are meant to be recommendations based on the literature currently available, regarding the best practice to carry out lung cancer screening. The management of patients once a diagnosis of lung cancer has been established is outside the scope of this document. It is important to recognize as well that different provinces and regions will have variable resources to dedicate to the purpose of lung cancer screening, and may need to modify their screening practices to reflect this reality.

LDCT for lung cancer screening is still a relatively new field and best screening practices are still being established. This guide is meant to reflect the best evidence currently available. Recognizing that this is a rapidly evolving area of medicine, the guide will be revised as needed.

Population and Statistics

In Canada, lung cancer is the leading cause of cancer-related death in both genders [3]. Although the incidence of lung cancers in men has been decreasing since the mid-1980s, and the incidence in women is no longer increasing, it is estimated that there were 26,600 new cases of lung cancer in Canada in 2015 and 20,900 deaths due to lung cancer [3].

The 2 most common risk factors for lung cancer are exposure to cigarette smoke and increasing age. Smoking is associated with approximately 85% of all lung cancer cases [4]. Although the prevalence of smoking has decreased, 18.1% of Canadians (approximately 5.4 million people) were current smokers in 2014; 20.2% of Canadians 45-64 years old and 9.4% of people 65 years old and older are still smoking [5]. The highest incidence of new cases of lung cancer is seen in age groups of 60 years old and older, although there are also a significant number of cases in the 50-59-year-old age group [3].

Lung cancer has a poor prognosis, and more than 90% of persons with lung cancer die of the disease [6]. However, early-stage lung cancer has a better prognosis and is potentially curable. The 5-year survival for stage I lung cancer is 66%-82% [7]. Unfortunately, the majority of lung cancers are only detected at an advanced stage where the 5-year mortality rate is much higher than for earlier stage cancers. From 2006-2008, the overall 5-year relative survival ratio for people diagnosed with lung cancer was 17% [3].

Summary of Current Evidence

In recent years, the results of several European and North American randomized control trials evaluating the utility of annual LDCT for the detection of lung cancer have been published. The largest and most robust of these studies is the National Lung Screening Trial (NLST), which enrolled more than 50,000 patients. It evaluated participants 55-74 years old, with a smoking history of at least 30 pack-years, and who were either current smokers or had quit within the past 15 years. The result of the NLST, published in 2011, showed that screening CT, when compared to screening chest radiograph, resulted in a 20% decrease in lung cancer specific mortality and a 7% decrease in overall mortality [8].

Other smaller European trials failed to show any benefit of LDCT for lung cancer screening. For example, 2 small fair-quality trials, the DANTE (Detection and Screening of Early Lung Cancer by Novel Imaging Technology and Molecular Essays) trial (n = 2472) and the DLCST (Danish Lung Cancer Screening Trial) (n = 4104) did not show any benefit associated with LDCT compared with no LDCT [9–11]. A recent update of the DLST study with longer-term follow-up did show a stage shift in the highest stage screening group as compared to the control group [12].

The smaller sample size of these studies may have had limited power to detect a true benefit. In addition, the DLCST included lower risk (younger and healthier) participants than in other trials such as the NLST. A third study, the MILD (Multicentric Italian Lung Detection) study, was rated as poor quality because of concerns about the adequacy of randomization [13]. The NELSON (Nederlands-Leuvens Longkanker Screenings Onderzoek) study is a trial of lung cancer screening comparing LDCT with no screening. The NELSON trial is currently ongoing [14]. When the results of the NLST, DANTE, and DLCST trials were combined in a meta-analysis, the combined relative risk for lung cancer mortality was 0.81 (95% confidence interval: 0.72 to 0.91) [15].

Qualifications and Responsibilities of Personnel

Training Requirements for Radiologists Interpreting Screening Examinations

There are currently no recommendations in the literature to indicate specific qualifications for radiologists reporting lung cancer screening studies, unlike other screening examinations such as mammography, where specific training requirements and a minimum number of studies are recommended [16,17]. The American College of Radiology (ACR) currently recommends only that radiologists reporting lung cancer screening CTs meet the general requirements for reporting CT scans [18]. As screening becomes more widely established, training criteria for the radiologist may become part of the process to demonstrate adequacy as a screening site. Double reading and expert reading have been found to improve sensitivity and specificity for nodule detection and characterization [19], suggesting there is likely a role to play in radiologists needing at least some initial training or supervision when beginning to read lung cancer screening studies.

The following best practice guidelines for radiologists reporting lung cancer screening studies are recommended:

1. CT screening for lung cancer should be reported by radiologists who are committed to maintaining up-to-date