ELSEVIER

Canadian Association of Radiologists Journal 65 (2014) 121−134

CANADIAN ASSOCIATION OF RADIOLOGISTS JOURNAL

www.carjonline.org

Thoracic and Cardiac Imaging / Imagerie cardiaque et imagerie thoracique

The Lung Reporting and Data System (LU-RADS): A Proposal for Computed Tomography Screening☆

Daria Manos, MD[a,*], Jean M. Seely, MD[b], Jana Taylor, MD[c], Joy Borgaonkar, MD[a], Heidi C. Roberts, MD[d], John R. Mayo, MD[e]

[a]*Department of Diagnostic Radiology, QE II Health Sciences Centre, Dalhousie University, Halifax, Nova Scotia, Canada*
[b]*Diagnostic Imaging, The Ottawa Hospital, University of Ottawa, Ottawa, Ontario, Canada*
[c]*McGill Health Center, Montreal General Site, McGill University, Montreal, Quebec, Canada*
[d]*Department of Medical Imaging, Women's College Hospital, University of Toronto, Toronto, Ontario, Canada*
[e]*Department of Radiology, University of British Columbia, Vancouver, British Columbia, Canada*

Abstract

Despite the positive outcome of the recent randomized trial of computed tomography (CT) screening for lung cancer, substantial implementation challenges remain, including the clear reporting of relative risk and suggested workup of screen-detected nodules. Based on current literature, we propose a 6-level Lung-Reporting and Data System (LU-RADS) that classifies screening CTs by the nodule with the highest malignancy risk. As the LU-RADS level increases, the risk of malignancy increases. The LU-RADS level is linked directly to suggested follow-up pathways. Compared with current narrative reporting, this structure should improve communication with patients and clinicians, and provide a data collection framework to facilitate screening program evaluation and radiologist training. In overview, category 1 includes CTs with no nodules and returns the subject to routine screening. Category 2 scans harbor minimal risk, including <5 mm, perifissural, or long-term stable nodules that require no further workup before the next routine screening CT. Category 3 scans contain indeterminate nodules and require CT follow up with the interval dependent on nodule size (small [5-9 mm] or large [≥10 mm] and possibly transient). Category 4 scans are suspicious and are subdivided into 4A, low risk of malignancy; 4B, likely low-grade adenocarcinoma; and 4C, likely malignant. The 4B and 4C nodules have a high likelihood of neoplasm simply based on screening CT features, even if positron emission tomography, needle biopsy, and/or bronchoscopy are negative. Category 5 nodules demonstrate frankly malignant behavior on screening CT, and category 6 scans contain tissue-proven malignancies.

Résumé

En dépit des résultats positifs d'un récent essai clinique randomisé visant le dépistage du cancer du poumon par tomodensitométrie (TDM), l'instauration ou la diffusion des pratiques de dépistage continue de soulever des défis de taille, en ce qui concerne notamment la classification non équivoque du risque relatif et le bilan proposé pour évaluer les nodules décelés par dépistage. Après avoir analysé la documentation scientifique actuelle, nous avons formulé une proposition de système de données et de déclaration à six niveaux, appelée méthodologie LU-RADS (Lung-Reporting and Data System), qui permet de classifier les résultats des tomodensitométries de dépistage en fonction du nodule présentant le risque le plus élevé de cancer du poumon. Dans le cadre de la méthodologie LU-RADS, plus les résultats correspondent à un niveau élevé, plus le risque de malignité est élevé. Le niveau LU-RADS renvoie également directement à des recommandations concernant le cheminement de suivi. Ainsi, comparativement aux comptes rendus descriptifs actuels, cette méthodologie devrait améliorer la communication avec les patients et les cliniciens, et fournir un cadre de collecte de données qui facilitera l'évaluation du programme de dépistage et la formation des radiologistes. En résumé, dans le cadre de la méthodologie LU-RADS, la catégorie 1 correspond aux examens de tomodensitométrie qui ne révèlent aucun nodule et exigent simplement du patient qu'il poursuive le programme de dépistage périodique. Les résultats de catégorie 2 font état d'un risque minimal, notamment de nodules de moins de 5 mm, de nodules péri-scissuraux ou de nodules stables à long terme qui n'exigent aucune autre mesure avant la tenue de la prochaine tomodensitométrie de dépistage périodique. Les résultats de catégorie 3 révèlent des nodules de nature indéterminée. Une tomodensitométrie de suivi doit alors être réalisée, dans un intervalle qui varie selon la taille du nodule (selon qu'il s'agit d'un petit nodule de 5 à 9 mm ou d'un gros nodule de ≥ 10 mm et possiblement transitoire). Pour leur part, les résultats des examens tomodensitométriques de catégorie 4 présentent des caractéristiques

* Address for correspondence: Daria Manos, MD, Department of Diagnostic Radiology, QEII VG Site, Room 308, 1276 South Park Street, Halifax, Nova Scotia B3H 2Y9, Canada.

E-mail address: daria.manos@cdha.nshealth.ca (D. Manos).

0846-5371/$ - see front matter
http://dx.doi.org/10.1016/j.carj.2014.03.004

suspectes et se subdivisent en trois catégories: 4A, faible risque de malignité; 4B, probabilité d'adénocarcinome de bas grade; et 4C, probabilité de malignité. Les nodules des catégories 4B et 4C sont associés à une forte probabilité de néoplasie simplement en raison des caractéristiques observées par tomodensitométrie de dépistage, et ce, même si une tomographie par émission de positons (TEP), une ponction-biopsie ou une bronchoscopie révèle des résultats négatifs. Enfin, les nodules de catégorie 5 révèlent une séméiologie maligne nettement observable par TDM de dépistage, alors que ceux de catégorie 6 contiennent des tissus dont la malignité a été prouvée.

Key Words: Nodule risk; Lung cancer screening; Lung nodules; Low-dose computed tomography; National lung screening trial; LU-RADS

The success of computed tomography (CT) screening for lung cancer in the research setting challenges policy makers to provide universal access for patients at high risk. Many organizations, including the U.S. Preventative Services Task Force, recommend CT screening for patients at high risk [1–4]. However, implementation of screening outside the research setting is problematic, and appropriate concerns have been raised not only in the radiology literature [5,6] but also in the wider medical field [2,7]. Most radiologists are aware that lung nodules are common, the vast majority of nodules are benign, and that not all worrisome lung nodules require the same workup. However, primary care physicians and the public in general may not understand these principles. Indeed, a common perception among patients is that lung nodules are equivalent to lung cancer [8]. Successful implementation of screening CT programs will focus on clear communication of nodule malignant risk by the interpreting radiologist, which will help to avoid inappropriate referrals, repeated CTs, and interventions.

In this article, we propose a classification scheme for lung nodules found on baseline and follow-up screening CTs. The purpose of this classification is to facilitate communication with clinicians, provide a framework for data collection and analysis (including outcomes and quality assurance), and train radiologists new to screening CT. This classification scheme incorporates and summarizes existing guidelines and expert-opinion protocols (such as those produced by the American Academy of Chest Physicians, the National Comprehensive Cancer Network, and the Fleischner Society) and builds upon the strengths of existing screening classification systems [9–11]. It is acknowledged that the precise divisions of lung nodule categories and their corresponding management may vary among lung cancer screening programs based on resource availability. Furthermore, the subcategories may be refined as further evidence emerges. However, it should be emphasized that the principal aim of this document is to establish subcategories of nodules that differ substantially based on management and the likelihood of malignancy, and to establish a nomenclature that can assist clinicians and patients.

The Lung Reporting and Data System (LU-RADS) is based on the successful and widely accepted breast imaging classification, the BI-RADS (Breast Imaging Reporting and Data System; American College of Radiology, Reston, VA) [12]. LU-RADS includes 6 categories based on CT appearance, with an emphasis on serial CT findings. Each category is associated with a risk of primary lung malignancy and specific recommendations for workup. This categorization of nodules allows referring physicians a more sophisticated approach to a "positive" screening CT by emphasizing that different types of nodules require a different workup. A summary of the LU-RADS system, including the nodule characteristics for each category and the reporting and follow-up recommendations, is provided in Table 1. Because patients may harbor many nodules, the final recommendation on the CT report is based on the nodule with the highest risk of malignancy and the appropriate associated management strategy.

LU-RADS categories and management recommendations are based on a review of screening CT research in high-risk patient populations. The possible role of LU-RADS for the reporting and workup of incidental nodules or for nodules found in patients who are not at high risk for thoracic malignancy cannot be addressed in this article due to a lack of research evidence.

LU-RADS 1

Finding: No Nodule

Management: Return to Regular Screening

This category applies to screening CTs in which no nodules are seen. Although the likelihood of lung malignancy in the next 2 years is very low, malignancy may arise in a nodule present but not detected, an interval nodule, or a malignancy not detectable by screening [13,14].

Reporting and Management of LU-RADS 1 Nodules

Patients and physicians need to be made aware of the limitations of screening CT and should be reminded that, even after a category 1 CT, the development of concerning symptoms (eg, unexplained hemoptysis) should prompt clinical evaluation. The report also should include a recommendation to return to regular screening and specific information regarding the timing of the next screening CT.

LU-RADS 2

Finding: Benign Nodule

Management: Return to Regular Screening

This category includes nodules with an extremely high likelihood of benign etiology. For the current state of