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What CT characteristics of lepidic predominant pattern lung adenocarcinomas correlate with invasiveness on pathology?

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ABSTRACT

Objectives: The International Association for the Study of Lung Cancer, American Thoracic Society and European Respiratory Society lung adenocarcinoma classification in 2011 defined three lepidic predominant patterns including adenocarcinoma in situ, minimally invasive adenocarcinoma and lepidic predominant adenocarcinoma. We sought to correlate the radiology and pathology findings and identify any computed tomography (CT) features which can be associated with invasive growth.

Materials and methods: An institutional review board approved, retrospective study was conducted evaluating 63 patients with resected, pathologically confirmed, adenocarcinomas with predominant lepidic patterns. Preoperative CT images of the nodules were assessed using quantitative and qualitative radiographic descriptors while blinded to pathologic sub-classification and size. Maximum diameter was measured after evaluation of the axial, sagittal and coronal planes. Radiologic − pathologic associations were examined using Fisher's exact test, the Kruskal-Wallis test and the Spearman correlation coefficient (ρ).

Results and conclusion: Increasing maximum diameter of the whole lesion (ground glass and solid component) on CT was significantly associated with invasiveness ($p = .003$), as was the maximum pathologic specimen diameter ($p = .008$). Larger diameter of the solid component on CT was also found in lepidic predominant adenocarcinoma compared to minimally invasive adenocarcinoma (median 10.5 vs 2 mm, $p = .005$). More invasive tumors had higher visual estimated percentage solid component compared to whole lesion measurement on CT ($p = .014$). CT and pathologic measurements were positively correlated, although only moderately ($\rho = .66$) for the maximum whole lesion size and fair ($\rho = .49$) for solid/invasive component maximum measurements. Larger whole lesion size and solid component size of lepidic predominant pattern adenocarcinomas are associated with lesion invasiveness, although radiologic and pathologic lesion measurements are only fair-moderately positively correlated.

1. Introduction

Lung cancer remains the second most commonly diagnosed major cancer for both men and women in the United States and the most common cause of cancer death for both sexes, accounting for 1 in 4 cancer deaths. The American Cancer Society estimates that in 2017, there will be 222,500 new cases of lung cancer and 155,870 deaths from lung cancer [1]. Of all histological subtypes of lung cancer, adenocarcinoma is the most common, occurring in approximately 40% of cases [2].

In 2011, the International Association for the Study of Lung Cancer, American Thoracic Society and European Respiratory Society defined three new sub-classifications of lepidic predominant pattern adenocarcinomas in order to integrate advances across multiple disciplines including not only pathology but medical oncology, molecular biology and radiology: adenocarcinoma in situ (AIS), minimally invasive adenocarcinoma (MIA) and non-mucinous lepidic predominant adenocarcinoma (LPA) [3]. In 2015, these sub-classifications were adopted by the World Health Organization [4]. Most recently, in 2017, the 8th edition lung cancer TNM classification incorporated the sub-

Abbreviations: AIS, adenocarcinoma in situ; CI, confidence interval; CT, computed tomography; MIA, minimally invasive adenocarcinoma; LPA, lepidic predominant adenocarcinoma; WL, whole lesion; SOL-C, solid component; TNM, tumor, node, and metastasis

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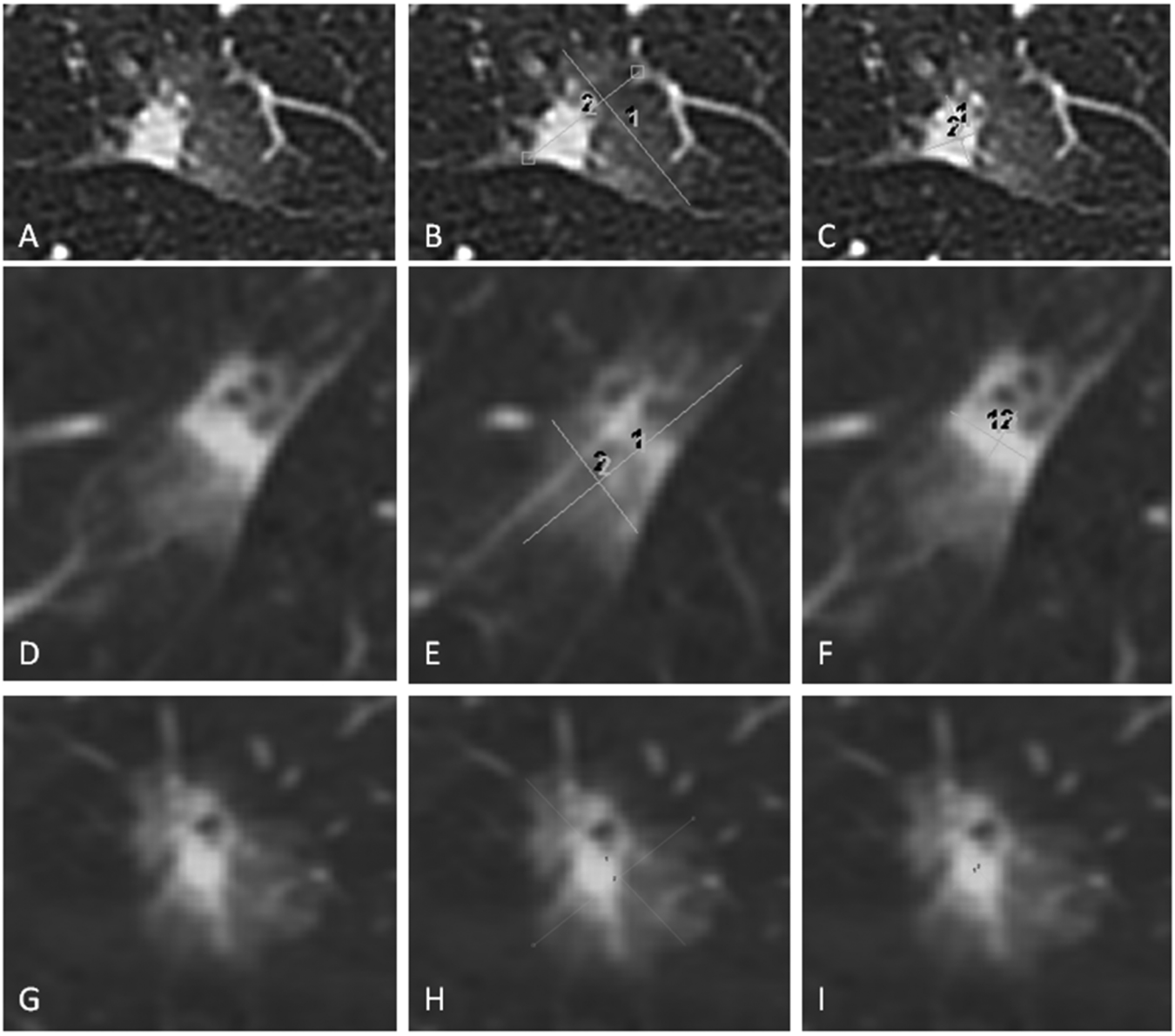

Fig. 1. Measuring lesions on CT. (A–C) Axial CT images of a subsolid lesion with (B) measurement of the whole lesion in maximum long axis and a perpendicular measurement and (C) measurement of the solid component in maximum long axis and a perpendicular measurement. (D–F) The lesion and measurements taken in the sagittal plane. (G–I) The lesion and measurements taken in the coronal plane.

classifications and made corresponding revisions to the T component of tumor, node, and metastasis (TNM) designation for lung cancer [5–7].

The change in pathologic classification requires an evaluation of the radiologic-pathologic correlation for optimal classification of these new lesions. As AIS and MIA categories were proposed based on evidence that patients would have a 100% or near-100% disease-free survival, respectively, if completely resected, it is vital that they can also be accurately identified and characterized on imaging. Data from our group suggest that even LPA have an excellent prognosis with 90% disease-free survival, and recurrence is associated with high risk features such as micropapillary component, visceral pleural or vascular invasion and close margins [8]. The purpose of this study was to determine the CT features of lepidic predominant tumors which correlate with histologic features of invasive growth.

2. Materials and methods

2.1. Patient population

This retrospective study was approved by the Institutional Review Board with a waiver of informed consent and was compliant with the Health Insurance Portability and Accountability Act. A review was performed to identify consecutive patients with resected, histopathologically confirmed lepidic predominant pattern tumors over a two year period from April 1, 2014, to March 23, 2016. We included all patients whose pre-operative CT imaging was performed up to a maximum of 2 months prior to surgery and which were available for evaluation in the picture archiving and communications system (GE Centricity, Chicago, IL). We excluded one patient in whom the lesion which was described on the pathology report but could not be definitely identified on CT.

2.2. CT image acquisition

We reviewed CT studies performed at our institution as well as those