

Toward a Definition of Lung Nodule: A Visual Nodule Library Resource

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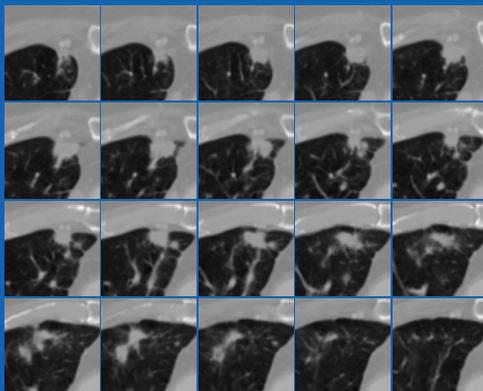
To stimulate the advancement of computer-aided diagnosis (CAD) research for lung nodules in computed tomography (CT) scans, the National Cancer Institute (NCI) launched a cooperative effort known as the Lung Image Database Consortium (LIDC), the mission of which is, in part, “to develop an image database as a web-accessible international research resource for the development, training, and evaluation of CAD methods for lung cancer detection and diagnosis using helical CT.”

As a necessary prerequisite to the development of such a database, fundamental issues are being addressed through a consensus process. Foremost among these issues is:

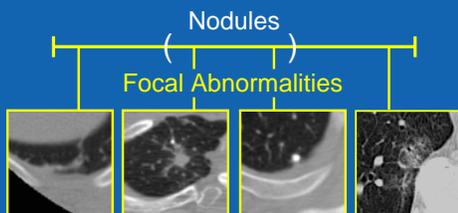
What is a nodule?

For thoracic CT, a nodule has been defined as a “round opacity, at least moderately well margined and no greater than 3 cm in maximum diameter” (1).

The application of this definition is sometimes difficult in clinical practice due to wide variations in the morphology of lung lesions. Consider the lesion below: Does its complex three-dimensional shape qualify it as a “nodule”?



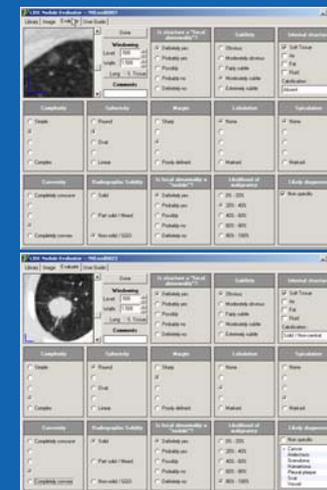
A utilitarian definition of “nodule” is not straightforward. The notion of “nodule” may not represent a single entity. Instead, the term “nodule” is more appropriately applied to a spectrum of abnormalities, which is itself a subset of a broader spectrum of abnormalities termed “focal abnormalities” (2).



These two spectra span a multidimensional space that comprises lesion characteristics such as shape, texture, and margin sharpness.

The LIDC is creating a visual nodule library to capture image-based examples of lesions that span the “nodule” and “focal abnormality” spectra. All nodules in the LIDC Database will be characterized by a panel of experienced thoracic radiologists according to nodule characteristics captured in the visual library. We have developed an interface around a set of common data elements (including margin, lobulation, spiculation, sphericity, internal structure, convexity, and radiographic solidity) intended to capture the salient characteristics of lesions on CT.

The interface is shown below with example lesions that were rated by an LIDC radiologist. Note that the nodule display window allows for the lesion to be viewed in all CT sections in which it appears so that the three-dimensional nature of the lesion may be considered.



Through the evaluation of a wide variety of lesions that exist within the “focal abnormality” spectrum, the LIDC is creating a visual nodule library, which should allow for a more complete understanding of lesions that radiologists term “nodules.”

RSNA 2004 Education Exhibit

REFERENCES

- 1) Austin JHM, Mueller NL, Friedman PJ, Hansell DM, Naidich DP, Remy-Jardin M, Webb WR, Zerhouni EA. Glossary of terms for CT of the lungs: Recommendations of the Nomenclature Committee of the Fleischner Society. *Radiology* 1996; 200:327–331.
- 2) Armato SG III, McLennan G, McNitt-Gray MF, Meyer CR, Yankelevitz D, Aberle DR, Henschke CI, Hoffman EA, Kazerooni EA, MacMahon H, Reeves AP, Croft BY, Clarke LP, The Lung Image Database Consortium Research Group. Lung Image Database Consortium: Developing a resource for the medical imaging research community. *Radiology* 2004; 232:739–748.

