Imaging Features of Nodules: What Makes a Lung Nodule High Risk for Cancer?

As you might suspect, there are features of different solitary pulmonary nodules (SPNs) that makes us more or less suspicious for cancer. The first is the size of the nodule. Looking at multiple series of SPNs, the likelihood of cancer among nodules that measured under 5 mm is generally in the 0-1% range. Nodules in the 5-10 mm range have been found to be cancer in up to about 28% of cases, with most studies showing the risk of cancer in this range to be one in four or five. SPNs in the 1-2 cm range are found to be cancer about 40-50% of the time, and beyond that, the risk is up to about 60-80%. But even among the larger ones, that go from being a nodule to a mass (3 cm cutoff), the likelihood of cancer isn’t 100%, and there are many things that turn out to be infection or inflammation or another benign cause.

In general, smooth borders for a nodule are somewhat reassuring, especially solitary ones. Metastases from other places tend to be smooth and toward the outside of the lung, so that’s an exception of when smooth edges can be a bad thing. The most common shape of a primary lung cancer is spiculated, or stellate, with little projections, so it has irregular borders.

Then there’s the issue of the density of the nodule. Solid nodules appear as pretty uniformly white on the CT (example in my prior post), while those that are just hazy clouds are called ground-glass opacities, or GGOs. In between is a nodule that appears to have areas of non-solid haziness next to other areas that are solid. These are called, coincidently, semi-solid nodules or opacities.

Ground-Glass and Semi-Solid Opacities

Ground-Glass Opacity (GGO)  
Semi-Solid Opacity

(Click to enlarge image — but it still may be hard to see the haze around the nodule on the right image)
We’re still learning more about what these characteristics signify. Some of the I-ELCAP work has suggested that the patients with the highest risk of a nodule being cancer are the ones with a semi-solid nodule. Others have shown that pure GGOs are more likely to be cancer, up to about 2/3 or 3/4. But as you can get a sense from the images, these aren’t the most rigid definitions. When I hear GGO, I think that this could be a pneumonia (often described as consolidation, another term for similar haziness that is more dense and obscures the underlying blood vessels in a way that a GGO shouldn’t), but it’s also a classic descriptor of a BAC cancer. Many of us think that the GGO portion corresponds to a non-invasive or “pure BAC” component, while the solid part of a semi-solid nodule often corresponds to an invasive portion of an adenocarcinoma that has some non-invasive BAC features around it (this spectrum that includes some areas of invasive BAC and other areas of invasive adenocarcinoma is described in a prior post). The other thing that we tend to see is that the level of metabolic uptake (the standard uptake value, or SUV) increases when you move from a higher percentage of GGO (or, under the microscope, non-invasive BAC) to a more solid nodule (more invasive cancer). This shouldn’t be surprising because PET scans identify concentrations of cells that take up labeled sugar molecules, and a solid nodule is a denser collection of cells than an air-filled GGO.

Enough for now: next we’ll move to growth patterns and doubling times.