Lung Nodule Growth Rate: An Important Factor in Assessing Risk of Cancer

A cancer has to grow faster than the tissue around it to become a tumor. Progressive growth is therefore a central feature of a cancer and a critical factor in distinguishing cancerous nodules from benign ones. There is a characteristic “volume doubling time” (VDT), the interval it takes for a nodule to double in volume. It’s worth keeping in mind that because a nodule is generally spherical, an increase in the diameter by just 28% (such as a 2 mm increase from 7 to 9 mm) actually represents a doubling of the volume of a nodule.

So we expect a cancer to grow, but there’s a lot of variability in the rate of an individual cancer’s growth. We know that different histologies (cancer subtype under a microscope) have different growth characteristics: SCLC has a typical VDT of 30 days, while NSCLC has an average VDT of 100 days. But on one end of the spectrum for NSCLC, a poorly differentiated adenocarcinoma or squamous cell carcinoma may have a VDT in the range of SCLC, while a well-differentiated cancer like many bronchioloalveolar carcinoma (BAC) tumors may have a VDT of more over a year. So by observing a nodule over time, we can learn a good bit about the probability of it being a cancer. For instance, nodules that grow incredibly quickly (VDT less than a week, for instance) are far more likely to be infection than cancer, and those that go for a year and a half or so without doubling are generally too slow-moving to be cancer. The common definition of stability is a lack of change over two years of observation, and then patients with a nodule being followed are generally felt to have a very low likelihood of cancer. However, I’ve seen a few cancers that didn’t have convincing growth until more than two years of follow-up had been completed (although a cancer that takes 3-4 years to double is likely to be much less life-threatening over the next several years than a more typical, faster growing lung cancer). And there’s always a rare very rapidly growing cancer that can grow remarkably during a period of observation. The key is weighing the risk of watching (which usually helps to clarify the risk that a nodule really is cancer or not) vs. the risk of jumping in and overtreating lots of nodules that aren’t cancer after all.

Among the key principles is that it’s not sufficient to just “eyeball” a nodule, but rather to have a radiologist carefully measure the nodule on a scan. And the level of detail required necessitates follow-up CT scanning rather than chest x-rays. Even with measuring nodule diameter on CT scans, very small nodules of just a few mm can differ in their apparent size just as a function of where the CT slices through the nodule (slice cuts may be every 3-5 mm for example). Imagine the difference between cutting through an orange through the middle vs. toward one side. If you only see the cross-sectional size, different cuts can give a different sense of the same nodules.

As I suggested in the discussion above about how tumor histology correlates with VDT, there have been studies that have looked at different kinds of tumors and their typical doubling times. For instance, ground glass opacities typically have the slowest VDT, with solid nodules a faster VDT, and “semi-solid nodules” in between the two (abstract here). In this study, the median VDT for pure GGOs was 813 days (as in, more than two full years), underscoring the point that some of the most indolent cancers, predominantly BACs, can grow remarkably
slowly but still be a cancer (see prior post here about some of the issues with the most indolent BAC tumors).

Finally, there’s a website that includes a doubling time calculator, in which you input the dates of your CT scan studies and the size of the nodule. The calculator is here (and there’s also some more information on imaging of lung cancer).

The key points, though, are that cancers should grow over time of being observed on CT, and while there is a lot of variability in how quickly lung cancers grow, the fastest and slowest moving are less likely to be cancer than the ones that double over something in the range of a month to a year or so. The ones with convincing but not extremely rapid growth are the most suspicious for cancer.