Types of Lung Cancer Resection: From Pneumonectomy to Wedge Resection

Surgery is the standard treatment for early stage lung cancer, sometimes also including other types of therapy in addition. There are many types of lung cancer surgery, and there is still active debate about whether a pneumonectomy or lobectomy should be the preferred surgery for lung cancer, or whether a sub-lobar resection, either a segmentectomy or a wedge resection, is appropriate for certain patients. We need to start with some definitions. There are two lungs (OK, everyone knew that…), and the right lung is bigger than the left one, because the heart sits predominantly on the left side of the chest. The lungs are divided into lobes, which in turn are divided into smaller segments. There are three lobes in the right lung (the right upper, middle, and lower lobes), and two in the smaller left lung. The left side has a projection called the lingula, which is a projection of the left upper lobe, and is a smaller but analogous structure to the middle lobe on the right side. The lobes are in turn divided into smaller anatomic segments.

A pneumonectomy is an easy concept: it’s the removal of a whole lung. This is commonly done, and may be required for a cancer that is central in the chest or large enough that it involves pretty much the entire lung. While no type of lung cancer is trivial, a pneumonectomy can be particularly challenging for patients, in light of all of the lung tissue that is removed (especially a right pneumonectomy, since it is the bigger lung). The majority of lung surgeries, however, are lobectomies, in which 1/3 of the right lung, or 1/2 of the left lung is removed, as illustrated here (this and other figures here are courtesy of my good friend and great thoracic surgeon Eric Vallieres, also at my institution).

![Diagram of lung lobes](https://example.com/lung_diagram.png)  
(click to enlarge)

On the right side, it is also possible to do a bi-lobectomy, involving the right upper and middle lobes, or the right lower and middle lobes, leaving one lobe behind.

The current standard of care for curative treatment of early NSCLC in a medically fit patient is a lobectomy or pneumonectomy. Because our major goal is to remove all of the cancer with as little additional normal tissue removed as possible, it’s appropriate to ask if we can get away with doing a smaller resection (“sublobar” resection) without compromising the outcome from the cancer. We want to do a thorough job in removing the cancer without significant compromise, either of the chance for a cure of cancer or of a patient’s pulmonary function and quality of life. There are two main types of sub-lobar resections. A segmentectomy is resection of one of the smaller components of a lung lobe, following the natural anatomic division of that portion of the lung. In contrast, a “wedge resection” is a surgery in which what is removed is a
wedge cut from the lung that does not follow the natural division of the lung lobe based on anatomy, generally just enough to remove the part of the lung with the tumor and a margin of normal lung tissue around it. The figures for both of these types of surgery are shown below:

(click to enlarge either)

So can we do as well removing less lung tissue than a standard lobectomy? This question was asked in a trial conducted in the 1980s and reported more than a decade ago by a now-defunct collaborative research organization called the Lung Cancer Study Group. The group and the trial were led by Dr. Robert Ginsberg, a legendary thoracic surgeon who served as Chief of Thoracic Surgery at Memorial Sloan Kettering Cancer Center in NYC before returning to Princess Margaret Hospital at the University of Toronto, training many excellent and world-leading thoracic surgeons at both places before dying of lung cancer himself in a tragically ironic turn. In this study (abstract here), patients with stage I NSCLC were to be randomized to receive either a lobectomy or a more limited sublobar resection (segmentectomy or wedge resection). The trial started with 771 patients registered, but only 267 were ultimately able to be randomized, with the remaining 504 patients not eligible because they were found to ultimately have a benign nodule, positive lymph nodes, a different kind of cancer than NSCLC, or had a tumor that could not be surgically removed without a lobectomy because of limitations from size or location of the tumor. The results demonstrated that patients who underwent a wedge resection or segmentectomy had a three-fold higher risk of local recurrence (cancer returning in the same area as the original tumor), as well a strong overall trend toward a worse overall and cancer-free survival than patients who had a lobectomy (while not statistically significant, this was also a smaller trial than initially planned, which makes it much harder to demonstrate a significant difference between the two arms.

In the wake of this less than ideal but still very influential study, lobectomy has remained the standard of care overall, although there were certain cases in which a sublobar resection is still often considered to be particularly appropriate and particularly appealing as an option. I'll go over these situations in the next few posts. There is also the separate issue of full thoracotomy vs. video-assisted thoracic surgery, which I'll also discuss in the near future.