Dr. Harpole:
I mentioned a while ago that since the 1950s the standard has been lobectomy for patients with early-stage lung cancer. There are three lobes in the right lung and two on the left, so you take out one of those lobes with lymph nodes around it. The question that came in was, how many lymph nodes do you take out and what’s important? The Japanese have done lots of work on this and have felt that if you go in and take all of the lymph nodes out the chest, they thought that that would increase survival. So we completed a national trial in North America, including Canada, over a thousand patients where they were randomized to a lobectomy with either just sampling, which means just taking one lymph node out of each area of the chest – upper, middle, or lower – versus just taking them all out.

The primary objective was to look at survival and see if there’s a difference. What we found was not only was there no difference in survival but there was no difference in morbidity or complications if you just sampled the nodes. Now, this means you need to sample a lymph node from eight different positions in the chest but you don’t necessarily need to take all the lymph nodes out if it’s an early-stage patient. So, this has definitely changed our care.

The other advance has been in the minimally invasive approach to lung resection. My partners and I got together and had a consensus conference in 1998 with leaders around the world who were starting to do these thoracoscopies, which is using a TV camera through small holes to do lobectomies. We defined for a trial that we were in, what we felt like would be the definition for this. It means it’s totally anatomic and oncologic and thoracoscopic. What that means is that you don’t just staple across things in big masses, that you individually isolate the blood vessels and the bronchus and the lymph nodes and take them out one by one, just like you would do in an open procedure. However, you use only a small access incision that usually is about 4 ½ cm, that’s less than 2 inches or so. You don’t use any retractors or rib spreading, which is what causes the pain, putting the rib spreaders in. You take out the lymph nodes and if you can, then take out all the mediastinal lymph nodes at the same time.

Here’s a drawing of our approach, which shows someone from the right side. We do it through two little incisions – the lower incision is for the camera and the upper one for the instrumentation.

We’ve done well over a thousand now, but in our first five hundred you can see that the duration of having the chest tube or drainage in was only three days. The length of stay was around three days, which is our average. We had a very low conversion rate, which means you get in there, you just can’t do it, and our mortality was very, very small at 1%, which is a fraction of what it is for patients who had an open procedure.

We had no death in the operating room because initially people were saying this is not safe and of course we’ve proven it to be quite safe.

Comparing our thoracoscopic patients to those from that Z30 trial, which was the lymph node trial I just spoke about, the thousand patient trial, which was an open operation – in other words it was
a regular thoracotomy and a rib spreading. You can see the length of stay, the chest tube; pretty
much everything was less with the thoracoscopic approach in the same population of patients.

In summary, I think we’ve shown a lot of advantages to the thoracoscopic lobectomy. If you have
a very small incision and you don’t use a rib spreader, there’s certainly less pain and less
analgesia medicines required. You preserve pulmonary function because it doesn’t hurt on your
side, you’re able to breathe more. We get people back to work and full activity – I had people
playing golf and tennis at a week or ten days. The length of stay in the hospital is less, there’s
lower complications, and more importantly for us if the patients do well from this operation and
let’s say they do have some lymph nodes and are candidates to give chemotherapy after surgery,
they can get it sooner because frankly, a lot of our patients who have thoracotomies, they’re so
debilitated after surgery that they can’t get to chemotherapy on time. So, we found that was also
an advantage.

Over the last five years the robot has been introduced for thoracic surgery. The robot has been
used more in abdominal surgery and there no is a series of patients – up into the hundreds – of
centers that use the robot.

The robot certainly allows you to control more instruments. These are these little teeny arms that
fit into the chest. The surgeon sits at a separate console and an associate surgeon is at the table
with the robot.

The camera is definitely better, it’s about ten times visualization and it gives you stereoscopic
vision so it looks like you’re looking through binoculars where you can see with both eyes,
whereas with the regular thoracoscope that I use most commonly, it’s a flat TV screen so it
doesn’t give you the depth perception as you get from the robot.

The instruments are what we call wristed, so they move a whole lot more than our straight sticks
that we use, more like chopsticks that we use video-assisted surgery. And there are new
instruments coming.

The downside of the robot is the setup is much less flexible. It’s a machine, and it’s very
cumbersome, and it fills up the entire operating room. There are no data that show that its
outcomes are any better than a thoracoscopic, except for the fact that it takes longer over time.
The big problem is that these robots cost about one and a half million dollars and the use contract
on them is about a hundred thousand per year.

So, right now I think that they may be useful in the future. There are centers that do a lot of those,
and one of my partners does all of his lobectomies through the robot, but it certainly has not been
shown to be any better than other minimally invasive approaches.

In 2012 I mentioned that a lobectomy is a standard operation; well, what about patients who can’t
undergo a lobectomy? What if you have somebody with poor lung function or poor heart function
or other issues that can’t undergo that? Well there wasn’t a defined population for this. We have
all used smaller resections – we call them sub-lobar resections -- and we also know from and old
trial that if you take out less than a lobe, the chance of the cancer coming back locally goes from
4-5% in a lifetime to 20%, which is a significant increase.

So, one of our cooperative groups did a randomized phase III trial which we just finished where
we looked at wedge resection using a TV camera with or without using brachytherapy.
Brachytherapy are little seeds of radiation that you actually sow along the staple line and the
thought was that if you put this little bit of radiation right where you do the staple line, maybe you will decrease the risk or the rate of local recurrence. These were all patients who were not candidates for lobectomy, so they had strict criteria of bad pulmonary function, heart disease or on home oxygen.

This is the schema trial showing the randomization. arm 1 was just the resection, and arm 2 was the resection with brachytherapy. The goal of this trial was to see if adding this little bit of radiation locally was going to improve survival. The trial has finished accrual and it should have its events ready so that we will hear about it this year at ASCO in the spring. We look forward to seeing the results of this trial.

A second trial that’s undergoing right now is for the patients how have small tumors but have good pulmonary function. The question is, these are very, very small tumors, tumors less than dime-sized, do you really need to take the whole lobe out? This is analogous to doing a lumpectomy versus a mastectomy for breast cancer. We know that lumpectomy is appropriate for small breast tumors.

This trial now has over half accrued, you can see it in the yellow there, there are almost 500 patients on it and these patients were randomized to either lobectomy or this limited resection called the segment, which I’m going to go more into in just a second.

What is a segmentectomy? It was described back in the ‘30s by Dr. Churchill and Dr. Belsey at Massachusetts General Hospital in Boston. It’s sort of been a lost art until very recently; in the last ten years people rediscovered it as an option for very small tumors.

The difference between this and what we call a wedge resection – in a wedge resection you just a staple and take a chunk of the lung. The segment actually allows you to get the lymph nodes, the blood vessels and everything down in part of the lung. Each lobe has a few segments and by doing that you get what’s still an anatomic resection but you leave a lot more lung.

I list here a bunch of the different segments that one can do on each side, there’s about three or four on each side. And we hope this is going to be a useful operation.

In summary, I’ve tried to give you a little overview of some of the things that we’re doing in thoracic surgery so that we can improve the care of our patients with more localized lung cancer. We’ve certainly been able to improve the accuracy of staging in patients for multiple different therapies, and I can’t overemphasize that this is a team sport, lung cancer – it is the surgeon, it is the medical oncologist, the radiation oncologist, it is the pulmonologist, and it is the thoracic imagers, we all work together with our support teams to make sure that all the patients get the appropriate care.

We’ve certainly, with these minimally invasive approaches, have been able to extend the indications in patients who are now candidates for resection. I very seldom have a patient who’s not a candidate for lung resection, frankly it’s only people with ongoing coronary disease or some bad congestive heart failure that we can’t operate on, because we can take lung resections out of just about everybody now. And we’ve certainly been able to limit the morbidity and mortality with operative resections so that as we move forward and get less and less invasive, hopefully we’ll come up with ways of treating early stage lung cancer so that patients survive, do well, and will be able to get back to productive life.