Support for Yale Cancer Answers comes from AstraZeneca, committed to researching innovative treatments to address unmet needs in head and neck cancer. Learn more at astrazeneca-us.com. Welcome to Yale Cancer Answers with doctors Anees Chagpar and Steven Gore. I am Bruce Barber. Yale Cancer Answers features the latest information on cancer care by welcoming oncologists and specialists who are on the forefront of the battle to fight cancer. This week, it is a conversation about surgical advances in the treatment of lung cancer with Dr. Daniel Boffa. Dr. Boffa is a Professor of Thoracic Surgery at Yale School of Medicine and Dr. Chagpar is an Associate Professor of Surgery at Yale and the Assistant Director for Global Oncology at Yale Comprehensive Cancer Center.

Chagpar Let's talk about lung cancer. Most of us know that it is an incredibly common disease, it is the second most common malignancy in both men and women. How often is surgery a part of the care of these patients with lung cancer?

Boffa There are about 200,000 newly diagnosed lung cancer patients in the United States each year. And about a quarter of them have earlier stage cancer where surgery is the only treatment they will receive. Another 10-20% of them have intermediate stage cancer, where they will receive surgery and some other form of treatment, be it chemotherapy or radiation. So, around half of the lung cancer patients will be eligible for surgery at some point during their course.

Chagpar Tell us more about surgical advances. When we think about lung cancer surgery, that always sounds like a big operation, like somebody is cutting out part of your lung and you need your lungs to breathe; that might be a little bit difficult?

Boffa I would say the exciting changes in lung cancer surgery affect both what we have to offer and who we can offer it to. I think that what we have to offer has been tremendously improved by our advances in minimally invasive surgery. You are absolutely correct that the traditional approach to lung cancer used to involve a very large incision that required a fair bit of recovery and involved losing a fair bit of working lung tissue that could permanently alter the patient's quality of life. We now have embraced minimally invasive techniques, and these appear to reduce the frequency of complications and allow patients to return to their normal status much more quickly. The concern with minimally invasive surgery is always, is it as effective at curing cancer as the tried-and-true approaches? We have looked at this both nationally and the research teams at Yale have looked at this, and there is pretty strong evidence that the minimally invasive approaches are just as effective as the classic approaches through larger incisions. I think that most patients have an option that involves much smaller incisions and a faster recovery. That being said, the goal of cancer surgery is to have the cancer removed safely and completely. And I think it is important to have your cancer addressed by a surgeon who is comfortable doing a minimally invasive approach

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if that is appropriate, but also who is comfortable doing more complex procedures which may require having the lung cut apart and sewn back together kind of like a lung transplant, as that often allows us to save lung tissue. The other area which I think lung cancer surgery has made great strides is in who we are offering lung cancer surgery to. Most patients with lung cancer, but not all, have a history of smoking and therefore, their lung function is not normal and I think minimally invasive techniques have allowed us to perform surgery on patients who previously were borderline with respect to how much healthy lung tissue they had and their ability to recover from surgery. So, I think we have been expanding the pool of patients that we believe are eligible for surgery in part because of our use of minimally invasive surgery, but also our pulmonary colleagues have become better at supporting patients through surgery with various breathing treatments and inhalers and physical therapy and respiratory therapy and other steps to enhance recovery.

Chagpar Let's talk a little bit about that and break down some of the things that you said. One of the things that I was wondering about was this whole impact of smoking on lung function and how much lung you can remove. When you have a patient with lung cancer who is about to undergo an operation whether it is a big operation or a minimally invasive one, are they supposed to quit smoking before they have that surgery?

Boffa Yes. We prefer that all patients quit smoking before surgery. We have invested a fair bit of our resources in developing techniques to help people quit. Quitting smoking is one of the hardest things a person can do and we recognize that, but we also recognize the importance and the advantage that nonsmokers have in recovery and also with respect to cancer coming back. So, we and other hospitals have developed programs to help patients quit smoking and we encourage all of our patients to stop smoking. That being said, one out of seven patients who develop lung cancer has never smoked. So, it does affect both smokers and nonsmoker.

Chagpar But as you said, quitting smoking is one of the hardest things to do and even if you have these programs to help people quit, it may take a long time for them to quit smoking. Does that delay their lung cancer surgery?

Boffa We generally do not delay lung cancer surgery for the sole purpose of having a patient quit smoking. We offer counseling and medication between the time that they are evaluated in our clinic and the time they go to the operating room, and we support them after surgery with patches to ease the cravings as they recover from surgery. I do think that the majority of our patients end up quitting around the time of surgery or 8:23 into mp3 file https://cdn1.medicine.yale.edu/cancer/2018-YCA-1104-Podcast-Boffa_345534_5_v1.mp3after surgery because it certainly is an eye opener when somebody has been diagnosed with cancer, it really drives home the negative impacts that smoking can have in terms of how long and how well we

live.

Chagpar The other question I had when you were talking about minimally invasive versus open surgery with a big incision, one of the things you said was that you can take less normal healthy lung tissue, is that right? When we think about gallbladder surgery for example, whether you have a big cut or a laparoscopic gallbladder removal with little tiny incisions, you are still taking out the same gallbladder, but is it the case that in lung cancer surgery you are taking out less tissue when you do it in a minimally invasive way and more tissue when you are doing it in an open way?

Boffa No. The amount of lung tissue that is removed is a function of the tumor and the patient and their goals of life. We know that the chances of a cancer coming back are impacted by the size of the tumor and the degree to which it is growing into neighboring structures, but also the amount of lung tissue that is removed at the time of surgery for some tumors. We have gotten a lot better at characterizing the behavior of cancers so that tumors that even 5-10 years ago, we would remove an entire lobe, we realized that they are better behaving tumors and we can remove less lung tissue. But no, the amount of lung tissue is not dictated by the approach. In general, at centers that do minimally invasive and open techniques, they generally reserve the open techniques for the larger tumors which mandate removing greater amounts of lung tissue. I do think an important factor is balancing the ability to cure a cancer with the patient's quality of life. And that is a very individual decision I think as lung cancer physicians, we really need to understand what a patient's goals of care are and there are certainly patients who will do everything humanly possible to beat their cancer, and even if that means that their activities would be limited, they would want that. And there are other patients who have certain activities that define their quality of life and they would accept a less effective cancer treatment in order to save specific qualities of life. And as physicians, we really cannot make those judgments for patients, all we can do is offer an array of options and try to help patients figure out what is the best fit for them.

Chagpar In terms of the differences and the advantages of a minimally invasive approach versus an open approach, you are really taking out the same amount of lung tissue. You are taking out the same amount of healthy tissue versus diseased tissue, the only real difference then is the complication rate. Is that right?

Boffa It is the size of the incisions and it is the degree to which the tissues of the chest are bruised at the time of surgery. Thoracic surgeons have gotten to the point where even our traditional open incisions are nowhere near as long as they used to be. We used to

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perform surgeries through incisions that were 10-15 inches long. We rarely do that anymore, and even our open approach the incisions are 5 inches long and

that is our bigger incision. The big difference is by using instruments that go through plastic tubes between the ribs, it is much less traumatic to the tissues, and as a result, there is less pain, there is a faster recovery and there are fewer complications.

Chagpar What about operative time, are we faster with the minimally invasive approach than we are with the open approach?

Boffa In general, I think they come out to be about the same. It is tough to compare them now because we are reserving the open approach for cases that are more challenging, and so those would have been more time consuming. We have found that there is some correlation with the length of an operation at the extremes, but for the vast majority of patients, the few minutes really does not make a big difference in their ability to recover from the operation.

Chagpar We are going to learn a lot more about minimally invasive techniques and all kinds of surgical advances for thoracic malignancies right after we take a short break for a medical minute. Please stay tuned to learn more about surgical advances with my guest, Dr. Dan Boffa.

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Chagpar This is Dr. Anees Chagpar, and I am joined tonight by my guest, Dr. Dan Boffa. We are talking about surgical advances in treating lung cancer. Right before the break, Dan was telling us about half of the patients, half of the 200,000 patients that are diagnosed with lung cancer in this country every year are eligible for surgery, and surgery has made a great deal of advances over the last several decades, going from big incisions 10-15 inches to smaller incisions of 5 inches or so to now minimally invasive approaches, which have the advantage of less pain and less complications. Dan, I would assume that another advantage potentially is that these patients get out of hospital sooner, is that right?

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Boffa That is true. The average length of stay when a patient has a minimally invasive approach is about 30% shorter compared to somebody having an open approach. And that translates into a faster recovery to their baseline activities, meaning their ability to perform their normal daily routine as well as going back

to work.

Chagpar From a financial standpoint, we all know that the healthcare system is really bogged down in terms of the financial burden of disease, are these operations when done in a minimally invasive approach more cost effective or in fact cheaper than the open approach, simply because of the reduced length of stay or does it all come out in the wash?

Boffa That is a very complicated question only because there are costs to the healthcare system, but there are also patient costs and there are the economic considerations of a person's ability to return to work. I would say overall from a patient's cost perspective, there is no difference. There should be no difference in what a patient is exposed to. From the healthcare economy, I do believe that minimally invasive approaches ultimately do save hospitals money in reducing length of stay. There are some additional equipment costs that you do not have with open techniques, but I think the length of stay, the reduction in complication rates, ultimately save hospitals money.

Chagpar I wanted to unpack this whole minimally invasive approach because we use this term kind of like a cliché. What exactly are we talking about? Are we talking about using small incisions with telescopes that then show you the inside of the chest on a video camera, kind of like how we take out gallbladders these days or are we talking about other things as well?

Boffa Minimally invasive lung cancer surgery has a lot of similarities with minimally invasive surgery that patients are probably more familiar with, like having their gallbladder removed or your appendix removed through belly incisions. The concept is the same where there are small incisions and plastic tubes are inserted through those incisions, generally about the size of a straw and skinny instruments are inserted through these tubes and a camera, which is also about the size of a straw projects the anatomy on a screen, the surgeons are standing at the bedside and are operating the instruments from the outside of the patient and having the instruments perform activities inside the patient. There is a certain degree of magnification, so that in a lot of situations the ability of the surgeon to see what is going on is actually better with the minimally invasive approach.

Chagpar Is this something what some patients may have heard of – this concept of VATS, video-assisted thoracic surgery?

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Boffa Exactly. We have laparoscopic approaches in the abdomen or arthroscopic approaches in joints, the thoracoscopic approach is what we use in the chest. Now, minimally invasive can mean VATS, which is generally interpreted as the surgeons at the bedside holding the instruments using a camera, and then there is robotic minimally invasive surgery where there is a surgical assistant at the bedside, but the surgeon is at the robot console. They actually have a lot of

similarities, in that the size of the incisions, the concept of surgery happening inside the body through instruments that are being manipulated outside the body is very much the same. The robotic technique right now does not have a tremendous number of advantages with respect to the patient recovery. Where the robotic approach has some real advantage is that it allows some surgeons that were not comfortable with the VATS approach to move into a minimally invasive approach because it mirrors the open approach, the surgeon's interaction with the instrument is much more in line with what it feels like to do open surgery. I do believe robotic surgery, however, is the future because of what will be able to happen once the instrument is inside the body, more and more the range of motion of an instrument in the body that is attached to the robot is gaining degrees of freedom in what it can do. When you are performing standard VATS surgery, you could think of a chopstick through a straw, there is only so much movement on the outside that leads to movement on the inside. Whereas with the robotic approach, think of a tiny hand going through that straw and doing all the degrees of motion of a human hand. It is not there yet, but I think that is the direction it is going and when it gets to that point, the array of procedures that can be done through small incisions will increase exponentially and I think that further reduces the trauma to tissues.

Chagpar If we extrapolate however to the current time where between VATS and a robotic approach, there is not much difference in terms of complication rate, but presumably the robots are far more expensive. So, from a health system overall cost perspective, is robotic surgery more expensive than VATS at the moment, although it may become the more cost-effective option in the long run?

Boffa Again, it is a complicated issue and one that we are actively studying here. Patients will not be exposed to any differences in costs no matter how their surgery is performed. You are absolutely right, there are upfront costs to acquiring the robot and the instruments that go with the robot; however, we are using the robot across a wide array of fields of medicine; for example, urology, gynecology, a lot of the abdominal surgeons are starting to use the robot; therefore, you average the cost of acquisition requiring the robot over a large number of procedures and it becomes pretty comparable after a relatively short time to the other minimally invasive approaches. Right now, I think that the ability to do surgery safely and the ability for patients to recover, whether it is done by VATS or by the robot, is very similar. That being said,

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there are some procedures where I do think the robot does offer some advantages. I think for a select group of thymic tumors, which is a tumor that lives under the breast bone, most of them can be accessed and removed via VATS, but there is a subset of them that I really believe the robot does a better job; again because of those additional degrees of freedom of the instrument moving once it is in the body.

Chagpar But for lung cancer, is there any particular criteria that you use to determine whether a patient should have a VATS procedure or a robotic procedure? You were talking about how the open procedures, you tend to use for the bigger tumors, the uglier tumors, the one-third and bad locations, but between a VATS procedure and a robotic procedure, if a patient is eligible for a minimally invasive procedure, how do you define which patient gets which?

Boffa We really feel they are equivalent, and so it really depends on the preference of the patient and the preference of the surgeon. While we have clear criteria that we share across surgeons, both on our team and I would say within the surgical community internationally, I do not really feel there are strict guidelines to define a patient's eligibility for VATS versus robot. I think the field really feels that they are more similar than they dissimilar and that the eligibility criteria are pretty much the same.

Chagpar You mentioned patient preference, what factors go into the patient preference? Is it just that one sounds cooler?

Boffa Exactly. I have a number of patients that they definitely want the robot and they definitely want a laser, and it is I do not know where these ideas are coming to them, but they have clear expectations on how they want their surgery done and we try to be accommodating to the extent that we can, but our number one priority is to have the surgery be performed safely and to give them the most effective surgery in terms of curing their cancer as humanly possible.

Chagpar Are there patients who come to you, who you just say, "you know what, there is no surgery that I can do here, this is just not something that is approachable with any technique?"

Boffa There are patients in which surgery is unlikely to make them live longer or live better. The principle of surgery is you need to get all the tumor out and you need to have the patient survive the operation in a condition that is acceptable to them. And there are clear black and white issues. First, if you cannot get all the tumor out for example if a tumor was growing throughout the heart and the only way to get it out was to remove the heart entirely, you are not going to give somebody a heart transplant and remove

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their lung cancer tumor. So, if you cannot remove all the cancer, then surgery actually does not help patients. There is also the issue of can you leave patients in a condition that they find acceptable. I think this is a critical aspect and that changes from patient to patient. There are some patients where removing one lung does not affect their ability to do the things that they really enjoy doing. And there are others that have a certain need for activities in their life to enjoy their life and make their life meaningful, that would result in an unacceptable change in their quality of life. So, I think that it is highly variable. I think a key question now is are you going to get the same answer to those questions from

the same surgeon, and I think that to some degree it is very patient dependent, but it is also surgeon dependent, and Henry Ford used to say that whether you think it can be done or it can't you are usually right. I firmly believe that and I think there are surgeons who do not feel comfortable removing tumors that are growing into other structures and if a surgeon ever tells you that it is inoperable, not because it is spread but because of what it is growing into, I do think that is a good opportunity for a second opinion and that can be performed at a number of centers and I send some of my patients for second opinions if I feel that something cannot be removed or it is not the right thing to do if that is what they prefer.

Dr. Daniel Boffa is a Professor of Thoracic Surgery at Yale School of Medicine. If you have questions, the address is canceranswers@yale.edu and past editions of the program are available in audio and written form at YaleCancerCenter.org. I am Bruce Barber, reminding you to tune in each week to learn more about the fight against cancer here on Connecticut Public Radio.