



Lung

Robotic Surgery for Lung Cancer

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Welcome to Yale Cancer Center Answers with doctors Anees Chagpar, Susan Higgins and Steven Gore. I am Bruce Barber. Yale Cancer Center Answers is our way of providing you with the most up-to-date information on cancer care by welcoming some of the nation's leading oncologists and cancer specialists who are on the forefront of the battle to fight cancer. This week Dr. Anees Chagpar welcomes Dr. Justin Blasberg. Dr. Chagpar is Director of the Breast Center at Smilow Cancer Hospital and Dr. Blasberg is Assistant Professor of Thoracic Surgery and Director of Robotic Thoracic Surgery and they will be discussing robotic surgery for lung cancer. Here is Dr. Chagpar.

Chagpar Justin, let's start off by talking a little bit about lung cancer, how common it is and how it often presents.

Blasberg Lung cancer is a fairly common problem here in Connecticut and also across the country, that occurs most commonly in smokers, about 80% of our patients are smokers, but a fair number of our patients come in with a family history of lung cancer or exposure to dust or particles at work or having come from countries where there is lung cancer indigenous to that area, and there are about 175,000 cases per year in this country. We have a pretty significant population in the New Haven area of not only smokers but nonsmokers that we see for ulcerative diseases not only of the lungs but also the esophagus and the mediastinum.

Chagpar We often talk about different modalities, we talk about surgery, we talk about radiation, we talk about chemotherapy, how do patients get to you and how many of those patients are surgically resectable?

Blasberg About 15-20% of patients diagnosed with lung cancer have early stage disease and would benefit from surgery. In the world of lung cancer, there are 3 primary modalities for treatment, those would include some regimen of chemotherapy, radiation, and also surgery would play a role and based on stage of disease that one has, we would consider surgery either as a first modality to use or to consider chemotherapy and/or radiation upfront followed by surgery based on how advanced the disease is or where in the chest a particular tumor is located, so we work very closely with the multidisciplinary team. We meet weekly with radiation oncologists, medical oncologists or pathologists in a multidisciplinary conference and discuss our cancer cases and try and figure out what the best modality is and in what order to treat each of our respective patients. Every patient is a little bit different but the goal is always to try and use the tools in our toolbox in the most effective way to get the best possible outcome.

Chagpar Of all of the patients who present, about 15-20% will actually have surgery at some point?

Blasberg Correct.

Chagpar And so those tend to be the people who have early stage disease?

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Blasberg Correct.

Chagpar When we think about lung cancer surgery, your lungs are inside your chest, your chest has ribs, and it used to be in the past where people would get these massive thoracotomies and people would be taking out a whole lung or a lobe or a couple of lobes, but have things changed?

Blasberg Things have changed, and there is a lot of good data to support smaller and smaller resections as we move along. Of course, there are different kinds of patient populations that we consider. We have some patients that can tolerate bigger surgeries, some patients who can tolerate smaller surgeries or not tolerate surgery at all, but the gold standard right now is to do what is called an anatomic resection where we take out a piece of lung that contains cancer and we resect that lung tissue following the distribution of the artery, the vein and the airway that serves that area of interest and so most of the time, we are not taking out the entire lung on one side, we are taking out one of the lobes; on the right, there are 3 lobes and on the left, there are 2, but we are becoming even more sophisticated in identifying patients who might benefit from smaller resections where we take out just segments of those lobes and then in patients who may be borderline for surgery, we can consider either just taking out the nodule itself or even radiating that area, so the data has become far more sophisticated to let us know to what extent resection or surgery is helpful, how much surgery is necessary and what benefit we might be able to give the patient even if we cannot do a traditional wide excision of that area.

Chagpar And as surgical techniques have evolved, we are making fewer and fewer big cuts, whether we talk about how we used to take out gallbladders and how we take out gallbladders now or how I used to do an axillary node dissection on everybody and now we do sentinel nodes, in thoracic surgery, things have evolved to be minimally invasive as well, can you talk a little bit about that?

Blasberg More and more we are using small incisions to do our operations but unlike some of the other cancer specialties, we are actually doing the same operation that we were doing 10, 20 and 30 years ago. We have not moved away from the thought that going inside and taking or performing anatomic resection is important and then sampling or dissecting of the lymph nodes in the area is important. We have not moved to the model of a sentinel lymph node or to do selective lymph node sampling, we still dissect and remove as many lymph nodes as we can see, but to your point, the incisions have gotten smaller and smaller and with the skill set for minimally invasive surgery, both in the 2 dimensional vision format like video assisted thoracoscopic surgery or 3 dimensional like robotic surgery, we are able to perform about 90-95% of our planned resections in a minimally invasive way. Those are for earlier stage patients and as we become more and more sophisticated with not only the technology but also our

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experience with those platforms, we are able to perform more and more advanced procedures with small incisions.

Chagpar A lot of people talk about robotic surgery. It seems a little bit like science fiction like you are using a robot to take out a cancer and it is really high-tech and jazzy. Tell us more about the actual procedure and is there more of a benefit aside from this is really cool technology and everybody goes wow, it is robotic?

Blasberg The robot has 3 dimensional vision which is unparalleled in our industry, in our section of the world in surgery. We are able to visualize structures in the chest that we can see with higher magnification with better resolution and we can see with either small incisions or even with our eyeballs looking inside in a traditional thoracotomy. The robot also allows for degrees of freedom to be able to move the instruments in a way that simulates open surgery as if my hand were moving, so unlike operating with sort of telescopic instruments and 2-dimensional vision, we are operating with much higher magnification, much better resolution and also with instruments that simulate open hand motion, so there are technical advantages for the surgeon to operate with the robot; however, the most important part of any of these operations is that we do a good cancer operation when we are in there and the goal of using a robot or the 2-dimensional imaging or the open surgery is to take everything out in an anatomic way to clear a patient of all disease and so the robot is just one tool to get that done. Ultimately, the operation is the same.

Chagpar And is the pain the same afterwards and the post-op healing the same, the length of stay the same?

Blasberg I think the pain and post-op healing, the length of stay, the quality of life in short term, the number of days to return to work, all of the metrics that we use that we think of traditionally as an advantage to minimally invasive surgery are not that different between a robot and just other minimally invasive tools that we have. The robot makes the operation easier for the surgeon. It does not necessarily change the outcome for the patient, although both the traditionally minimally invasive platform and the robot both get the patient out of the hospital faster and patients seem to complain of less discomfort in the chest wall when we use either of those modalities.

Chagpar Versus open surgery?

Blasberg Correct.

Chagpar And one would then think while okay you can get a few more degrees of freedom, it certainly is a little bit easier than doing things thoracoscopically, but ultimately, it is pretty similar to thoracoscopic.

Blasberg The outcomes should be the same, but the ability to perform advanced maneuvers in the chest, the ability to staple off blood vessels, to visualize angles, to be able to control not only the optics but instruments and multiple arms at one time allows for a very efficient operation and allows for an extremely thorough lymph node dissection in a way that I find to be more challenging with a standard or traditionally minimally invasive approach, so for the surgeon, I think there are significant advantages to the robot if one is facile with the robot. At the same time, I do believe that a surgeon facile with other minimally invasive techniques can accomplish the same goals with the same outcomes but it is just one more tool that allows us to perform our job well and give the patient the best possible outcome.

Chagpar Is the surgery shorter when you use the robot?

Blasberg The surgery is about the same. There is a slightly longer period of docking time, preparation for the room, and the staff needs to be trained in the robot, but once they become facile not only in the setup but also the procedure and the take down of the operation, I think there is an insignificant increased length of the operation. That increased amount of time spent on set up and take down is probably offset by the fact that the operation might be a little bit quicker with the robot. I would say give or take, it is about the same.

Chagpar And do you need special training in the robot as opposed to other surgeons who may never have used a robot, is there a learning curve?

Blasberg There is both special training and a learning curve, so the company that makes the robot we currently use requires any institution to complete an online training session, and may require you to go to a wet lab at one of their companies various sites across the country. You then have to be credentialed by doing a certain number of cases with a surgeon who is already credentialed to do that number and in some cases, you could be proctored or need to be proctored for an additional number of cases in order to obtain a certain amount of experience to become comfortable and then even after you have had that entire experience, it is encouraged for the new robotic surgeon to start with smaller cases to develop an increased comfort with the platform, just like any other minimally invasive surgery or any other open procedure for that matter, as one does more and more and more, they become more comfortable and become more proficient with it. The robot in particular I think requires a lot of training before one is comfortable to do it on their own and that is actually a requirement of the institution and of the company that makes it.

Chagpar It sounds to me like you get very used to the robot and then it is very helpful and you find that it improves how you can do the operation but you need that time to get trained on that equipment.

Blasberg You do and even after you have been trained to get good at it you need to have a certain number of touches per week, per month, per year, there is certainly a minimum number of

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cases and that number can be different based on how comfortable the surgeon is in terms of not being at the table and in terms of how good their staff is in the operating room, the person who is at the table switching the instruments and taking care of the table work is just as important as the surgeon sitting at the console doing the operation and it really requires excellent communication in the operating room and an experienced team so that things keep moving.

Chagpar We may have lost some of our audience who might not understand this bit about being at the table versus being at the console. Can you explain that to us a bit better?

Blasberg Sure, robotic surgery actually takes place in 2 locations, one is the patient who is on the traditional operating room table, who is connected to robotic arms through ports that are placed and then the second is the surgeon sitting at a console.

Chagpar Both of which are in the operating room.

Blasberg Correct.

Chagpar And we are going to pick up on that after we take a quick break for a medical minute to learn more about how exactly this robotic surgery happens, what it costs, and what are the risks and benefits to the patient, please stay tuned after this short break for a medical minute.

Medical Minute

It is estimated that over 200,000 men in the US will be diagnosed with prostate cancer this year with almost 3000 new cases in Connecticut alone. One in six American men will develop prostate cancer in the course of his lifetime. Major advances in the detection and treatment of prostate cancer have dramatically decreased the number of men who die from the disease; screening for prostate cancer can be performed quickly and easily in a physician's office using 2 simple tests, a physical exam and a blood test. Clinical trials are currently underway at federally designated comprehensive cancer centers such as Yale Cancer Center and at Smilow Cancer Hospital to test innovative new treatments for prostate cancer. The Artemis machine is a new technology being used at Smilow Cancer Hospital that enables targeted biopsies to be performed as opposed to removing multiple cores from the prostate for examination that may not be necessary. More information is available at yalecancercenter.org. You are listening to WNPR, Connecticut's Public Media Source for news and ideas.

Chagpar Welcome back to Yale Cancer Answers. This is Dr. Anees Chagpar and I am joined tonight by my guest, Dr. Justin Blasberg. We are talking about robotic surgery for lung cancer and for those of you who were with us before the break, we were just starting to unpack how exactly this happened and it might have been a little bit disconcerting when Dr. Blasberg started

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talking about well there is a surgeon at the console and then there is the patient on the operating room table and these are not necessarily in the same exact spot, although they are in the same room. Justin this may seem very scary for somebody who is lying on the table thinking, you have got the surgeon at the console which sounds very much like a gaming console but who is at the table, who is looking after the patient?

Blasberg So everyone in the room is taking care of the patient as in any other surgery that we do. The surgeon is not actually at the bedside but is in the room, so the way that the robot works, the surgeon is sitting in a chair, he is looking into sort of like a gaming console. There is a place where he places his head and looks into this machine and that gives him the ability to see the structures inside the patient in 3 dimensions and then he has controllers in front of him where he uses his hands to operate and manipulate the various arms of the robot that have been placed in a position where they need to be placed. The only difference between a robot and a traditionally minimally invasive surgery is that the surgeon himself is not actually at the table operating those instruments, those instruments are controlled by the robot through the console, so the surgeon's hands are actually moving the instruments but just not physically moving the instruments, he is moving the instruments through the console. It is not that different than the traditional minimally invasive surgery but it does require a specialized team, that team consists only of the surgeon at the console but also an assistant at the table who helps not to control the arms but to swap out the instruments that may be necessary to position instruments in the appropriate way and to communicate with the surgeon as to what they see or do not see or what they are comfortable with to keep the operation moving along, communication amongst that team is critical.

Chagpar And so all of us are visualizing the patient there with these tiny little incisions and you were very specific before the break about doing an anatomic resection, taking out the lobe of the lung if you need to or a wedge or a segment, but in an anatomic space and not cutting corners in terms of the operation itself, so how do you actually physically take out what could be a large segment of tissue through a tiny incision?

Blasberg The lung is like a sponge and is easily compressed, so when it is inflated, one would think that the lung is a large structure but when deflated, a lot of lung can actually fit through a small hole and actually even a tumor itself will compress and fit through a smaller hole in the chest wall, so that we are able to get this done and finish an operation even with small incisions. The procedure is typically carried out by identifying the structures that go to the area around the tumor, so there is always an artery, a vein and an airway that served an anatomic area and so we identify those, and on the right side, there are 3 lobes and on the left side, there are 2 lobes and so based on where a person has a lung cancer, we are able to isolate that artery, that vein and that airway to use the robot and other minimally invasive tools to isolate those vessels in that airway and then to divide them with the very sophisticated surgical staplers and then to remove that segment of the lung tissue and then to place them inside of a specimen

bag and take it out through a small incision, so that the patient is able to benefit from surgery that does not make big cuts like a traditional thoracotomy that does not divide a lot of muscle and cause a lot of pain like a traditional thoracotomy. We are still able to operate on fairly large tumors. We are able to do cases where patients have tumors up to 5 or 7 cm and take them out through small incisions. The bigger the tumor, the more difficult an operation is because of the amount of manipulation that is required, the lung like I said is a sponge but when there is a solid mass inside of it, it is definitely more difficult to manipulate but as we become more experienced with a robot we are expanding our indications and we are able to use that tool to the benefit of patients with even more advanced disease.

Chagpar So does every hospital have a robot that can be used for this?

Blasberg Not everyone has a robot and even hospitals that have a robot do not necessarily use it for thoracic surgery. The robot was more popular in its day with the urology surgeons and it has been used a lot in other oncology disciplines. It has been used more and more in thoracic surgery because of the benefit of not only the visualization but also the range of motion, the degrees of freedom of those instruments in a confined space, so I think in future years, the robot will see use in applications where it was not originally designed, it was not designed as a thoracic tool but it is used in some institutions exclusive for all thoracic surgery, at least for early stage patients.

Chagpar When we think about new technology, one of the things that everybody is very sensitive to is risk and benefit and you talked a little bit about the benefit for the surgeon being able to see things better you might even be able to see them with your naked eye, being able to move the instruments better than you would with traditional laparoscopic or thoracoscopic instruments, but not really a huge benefit in terms of the patient over regular thoracoscopic minimally invasive techniques and so given that, is there an additional cost to the patient that might be a risk as well?

Blasberg Typically, there is not a cost to the patient. Their insurance does not reimburse the hospital more for a robotic case than they do a VATS case or a thoracoscopic case. To the patient, there is not a difference in cost. That cost is incurred by the hospital itself and the purchase of the equipment and the maintenance of the machine and then the disposables meaning the instruments that have a limited lifespan. Unlike traditional open instruments which are typically made of stainless steel, they are minimal disposables. In the robotic platform, there are more disposables. All of the instruments that the robot uses to carry out the surgery have a limited lifespan. Sometimes, it is 10 uses or 20 uses, whatever that might be, there are more parts because it is far more sophisticated and more moving parts, there are more pieces that have to be replaced on a regular basis. That cost is not incurred by the patient and in fact, a lot of times I think the hospital finds the robotic platform to be the most desirable tool they have in its armamentarium and it is used as a way of recruiting or capturing a larger patient

population that are interested in that kind of platform. So it is never an expense to the patient. It is always of benefit to the patient without incurring any significant risk compared to other minimally invasive surgery.

Chagpar And so presumably if there is a hospital that has a robot, then it is a cost for the mainstay of the capital of the equipment and so they want to use it in a variety of platforms, not just in urology and gynecology but in thoracics and other things.

Blasberg And that is how we use our robotic systems here. We do share the time, we have block time, meaning we have dedicated time during the week that we do those cases with a dedicated team and although that sounds somewhat restrictive, it is actually a better system to have block time because we need a dedicated robotic staff and it is helpful as a surgeon, it is also helpful for the patients to have operative staff, anesthesia and nursing that is familiar with that platform every single day, even if it is urology one day, gyn onc another day, and thoracic surgery on a Wednesday, we benefit from having a team that is very experienced in that platform.

Chagpar How do you decide if there are patients who come to you whether to do things through VATS or whether to do things through a robot? Or is it more of, is there space on that particular day or are there particular characteristics that you look for that might make a patient more amenable to one or the other?

Blasberg There are a variety of scenarios. We do have a certain number of patients who come to our clinic or our offices and they want robotic surgery. They have heard about it, they have a friend who had robotic surgery, they have seen it on the internet, they have heard that this is something that is great and they want to know more about it. So a certain percentage of our catchment asks for robotic surgery. Aside from that population, we generally offer a minimally invasive surgery to all of our patients that would be a candidate. There are very few patients that have early stage disease, smaller tumors without lymph node involvement or with minimal lymph node involvement that we offer all of those patients some kind of minimally invasive surgery and in those cases, I always present to the patient the options of robotic surgery, minimally invasive surgery and then also as a plan B in case we have to convert our cases, in case the patient has newly found problems during the operating room, we always plan for an open incision just in case. I would say once patients are presented with minimally invasive or thoracoscopic surgery versus robotics, about 30 to 50% are very interested in a robotic operation because they do not necessarily care if there is a benefit to them. They like to know that there is a potential benefit to the surgeon himself or herself in terms of being able to carry out the operation. That is not to say that thoracoscopic surgery isn't also to accomplish the same goals in the same hands but the patients generally like the idea of being able to utilize the technology which makes the surgery a little bit easier.

- Chagpar One of the things you mentioned is always talking to patients about conversion to open if there is an issue. How often is it that there is an issue with robotic surgery and how quickly can you get from the console to the bedside in an emergency?
- Blasberg That is another great reason to have an experienced team because occasionally in all surgeries no matter how big or small the incisions and no matter how small or big the procedure, we always plan for vascular emergency and airway emergency, those are the things that we have to deal with in our line of work, so obviously the surgeon is not at the table and a robot is docked to the patient, meaning robotic arms are holding instruments that are inside the patient and so in an emergency, it is really important to be able to get to the table to be able to remove the robot and to be able to make an incision potentially to save a patient's life if necessary and so the operating room staff is trained in this and this kind of conversation happens before every single case. We talk about scenarios, emergency scenarios, we talk about maneuvers that would be necessary to save a patient's life, we talk about how to remove the robot and get it out of the way so that the surgeon and assistant can perform an open procedure if necessary and that in some cases, time is of the essence, that is an important conversation that we have before every single case.
- Chagpar How often is that ever utilized?
- Blasberg It is pretty rare. Vascular injuries in general in minimally invasive surgery, there has been no difference between minimally invasive thoracoscopic surgery or robotic surgery in terms of the risk of conversion, the percentage of conversions, the outcomes after conversion. We feel pretty comfortable about 90 to 95% of the time. When we start a minimally invasive procedure, we are able to finish it with small incisions. It is rare to have a vascular injury but when it happens, it is important to recognize it to treat it to be on top of the end, so we take the necessary precautions before every single case in the event there is a vascular emergency that we are prepared.
- Chagpar It sounds to me like this is really a technique that you will offer patients, almost everybody will be offered a minimally invasive approach. Are there any patients in whom you start and you think even before you get to the operating room this is a patient who needs an open procedure?
- Blasberg We talk about that before every case with every patient. We talk about the scenarios for conversion or the scenarios where we will have a lower threshold to make an open incision. So the patients are prepared psychologically, prepared in terms of their pain management that they will need after surgery or they are prepared about the activity level that we expect from them after surgery for recovering from an open procedure. We always talk about that scenario afterwards. For the most part, when we think that we can start a minimally invasive

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procedure, we are able to finish it minimally invasive, but occasionally, some patients with advanced disease do require bigger incisions and we still feel confident we are able to get them a good outcome that way.

Dr. Justin Blasberg is an Assistant Professor of Thoracic Surgery and Director of Robotic Thoracic Surgery at Yale School of Medicine. If you have questions for the doctors, 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 every week to learn about the progress being made in the fight against cancer here on WNPR, Connecticut's Public Media Source for news and ideas.