Yale CANCER CENTER *answers*

WNPR Connecticut Public Radio

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Less Invasive Options for Pulmonary Testing

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Welcome to Yale Cancer Center Answers with doctors Francine Foss and Lynn Wilson. I am Bruce Barber. Dr. Foss is a Professor of Medical Oncology and Dermatology, specializing in the treatment of lymphomas. Dr. Wilson is a Professor of Therapeutic Radiology and an expert in the use of radiation to treat lung cancers and cutaneous lymphomas. If you would like to join the conversation, you can contact the doctors directly. The address is canceranswers@yale.edu and the phone number is 1-888-234-4YCC. This week, Dr. Wilson welcomes Dr. Jonathan Puchalski. Dr. Puchalski is Assistant Professor of Pulmonary Medicine and Director of the Thoracic Interventional Program or TIP. Here is Lynn Wilson.

Wilson Let us start off by having you tell the listeners a little bit about what TIP is.

Puchalski TIP is a collaboration between several subspecialties. I am a pulmonologist that went through additional training to become an interventional pulmonologist, and I work closely with the thoracic surgeons, the medical oncologists, radiation oncologists and other pulmonologists in diagnosing and treating both lung cancer and other benign diseases.

Wilson What is the difference between someone who goes through internal medicine training and then a pulmonary fellowship, and the additional training that you did?

Puchalski I did an additional year of devoted time in interventional pulmonary medicine. So, directive therapy and advanced diagnostic and therapeutic procedures that deal with the inside of the lungs, the airways, and the area that surrounds the lungs called the pleural space. Through that very devoted training, which tends to be procedurally based, that's what distinguishes me from other pulmonologists and intensivists.

Wilson Tell us a little bit about how these collaborations work. You mentioned who you work with, but take us through a typical day so listeners can understand the collaborative nature of your work.

Puchalski On a typical clinical day where I spend time in the clinic with patients, often I have patients referred for this diagnostic test or therapeutic tests, but during that time, our thoracic surgeons, radiation oncologists, and medical oncologists are all working in the same large clinic space. So, if there is some test or some treatment that is better suited for one of my colleagues, we can easily have them see the people with whom I work and vice versa. Many times on a typical clinic day, I may be seeing the patients on my schedule but also floating into a couple of other rooms if the thoracic surgeons ask me to evaluate for their diagnosis or treatment, or the oncologists ask for some advice regarding airway or pleural diseases. During the rest of the week, my typical days are spent performing minimally invasive procedures, procedures, again, in the airways or in the pleural space aimed at diagnosing, for example, diagnosing lung cancer or treating similar things, such as opening up airways or draining fluid that can sometimes build up around the lungs in an effort to help people with cancer breathe better.

Wilson What are some of these minimally invasive treatments or procedures that are offered through the

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program? Go ahead and describe them in detail for us; for example, confocal microscopy, and VATS; tell us about the procedures that you do?

Puchalski I will start with the pleural procedures, VATS, for example. As surgery has advanced, thoracic surgeons, where they used to need to perform a larger surgery called a thoracotomy, an open thoracotomy, with new instruments and tools they are now able to use video assistance to perform a similar thoracic surgery. VATS is literally video-assisted thoracic surgery. They can make a couple small incisions and perform some of their surgical procedures completely through these small areas using video cameras. In the pleural space, I will perform a similar procedure called medical thoracoscopy, or pleuroscopy, which uses just a single entry site into this pleural space to either drain fluid and, in essence, glue the lung up to the rib cage, so the fluid cannot come back any more, thereby eliminating the patient's shortness of breath, which may be caused by this fluid, or even performing some biopsies in the area, getting some extra tissue to clarify, perhaps, a patient's diagnosis.

In the past several years, we have moved from a fairly large incision to just a couple of smaller holes with video assistance, or even one area, where we are able to enter that pleural space in a very minimally invasive way. Within the lungs, we can perform similar minimally invasive tests to diagnose, for example, lung cancer. If a patient has what looks like a lung cancer in an x-ray or a CAT scan, I can use something called a bronchoscope to go into the lungs, look around the tubes or the airways that go to the lungs, and either perform biopsies of visible areas within the airways or go farther out into what is called the center of the chest, the mediastinum, to diagnose exactly what is going on. This is fairly significant. These changes have really revolutionized our ability to diagnose lung cancer, masses in the lung, and nodules in the lung, because rather than a surgical incision through something called a mediastinoscopy, we can go right through the airway with no incisions and use special techniques, that I will describe in a second, to find these abnormal areas and perform biopsies.

For example, endobronchial ultrasound is called EBUS, and EBUS has a very small ultrasound on the end of a bronchoscope, and using this ultrasound from within the lungs, we can find the exact location of a lymph node, the exact location of a mass, perform biopsies in this area and it's a procedure that may take half an hour, or an hour and a half, a very short period of time, and the patient can come in, have the procedure, go home the same day within a matter of a half day with no incisions and virtually no significant recovery. Through EBUS, we are able to diagnose lung cancer. We can stage lung cancer and thereby direct various treatments, whether it is chemotherapy, radiation therapy, or surgery, for each individual's cancer.

You mentioned confocal microscopy. Confocal microscopy goes way out into the lungs, into the smallest air sacs in the lungs to try to see what those look like. They are called alveoli, but the confocal microscope can literally look at the alveoli and give some indications about what is going on far out into an area that we can never imagine seeing without this tool. That tool, specifically, has a ways to go before it's mainstream, but we are doing a lot of research on it here, and there are

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other tools. One is actually called peripheral EBUS, and the other is electromagnetic navigation, and both of those tools allow us, through the bronchoscope, to go far out into the lungs and specifically identify where a small nodule is in the lungs, and then perform the biopsies in a way that is significantly less risky than many other procedures, and with greater yield, and more accuracy than a lot of routine bronchoscopic procedures.

Wilson How does the navigation work?

Puchalski Electromagnetic navigation, you can imagine, is like the GPS system in your car. We obtain a CAT scan and are able to identify specifically where in the lungs, either a mass or a nodule is. We put that into a computer and allow our computer then to talk with the bronchoscope, more or less. The patient would come in, the procedure is essentially an advanced bronchoscopy, we will perform the bronchoscopy, but by targeting the lesion with the computer, we are able to go into specific airways that are otherwise very difficult to navigate into. Literally, a probe that comes out of the scope will allow us to both make a left turn and sharp angles that otherwise could not be done, and then advance this probe out specifically to the area that we are trying to biopsy. It is like being at the end point of your GPS map. We know where the target is, we can then use our other biopsy tools to specifically go to that area. For peripheral lesions, lesions that are farther out in the lung we need tools to go out this far, we can perform these biopsies using EMN and minimize risks, for example, if you need to go through the chest wall to perform biopsies or a surgical biopsy, with this the risks are minimal but our diagnostic rates are significantly better than they used to be.

Wilson This sounds intuitively obvious to me that it is easier for the patient; it is less invasive. Is this something that is commonly available at most centers, obviously with very specialized training? It sounds like the proper expertise to do this is required, but why is it that this isn't more widely available? Is it because physicians simply do not have the training? Is the technology cost-prohibitive? Why does not every center have the access to this or the expertise?

Puchalski I think both of those and more. First of all, from my perspective, it does take additional training to perform this procedure. It is something that requires a lot of dedication and devotion towards specific anatomical landmarks in the lung that have not always been practiced or even available, this is new technology, and so as technology emerges, people such as myself, this is what I do day in and day out, and so now we have these tools and the training to use these tools that make it different than a lot of other places. The other thing is exactly what you mentioned - it is expensive. This machine in and of itself can be upwards of $200,000 to purchase. It is certainly something that not every hospital can or should have, really. It is something that I think most people in the country, and in the world, believe should be offered at select centers for the cost aspects, and also from the expertise required to perform the procedure appropriately.

Wilson We are going to take a short break for a medical minute. Please stay tuned to learn more information about the Thoracic Interventional Program with Dr. Jonathan Puchalski.

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Medical Minute *It is estimated that nearly 200,000 men in the US will be diagnosed with prostate cancer this year, and over 2,000 new cases will be diagnosed 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 this disease. Screening for prostate cancer can be performed quickly and easily in a physician's office using two simple tests: a physical exam, and a blood test. Clinical trials are currently underway at federally designated comprehensive cancer centers, like the one at Yale, to test innovative new treatments for prostate cancer. The da Vinci Robotic Surgical System is an option available for patients at Yale that uses three-dimensional imaging to enable the surgeon to perform a prostatectomy without the need for a large incision. This has been a medical minute and more information is available at YaleCancerCenter.org. You are listening to the WNPR Health Forum on the Connecticut Public Broadcasting Network.*

Wilson Welcome back to Yale Cancer Center Answers. This is Dr. Lynn Wilson. Today, we are joined by Dr. Jonathan Puchalski, and we are discussing TIP, or the Thoracic Interventional Program. Jonathan, tell us a little bit about how long it usually is before cancer is diagnosed. Say, for example, a patient might get a chest x-ray that shows something or they might go to the doctor with a cough or they have problems with shortness of breath, what usually happens then, say here at Smilow, for example, with someone of your expertise and caliber, what would be the next step?

Puchalski You are right, oftentimes, patients will present with any of those symptoms. There is not really a specific symptom that suggests, you have lung cancer if you have this. Clearly a cough or shortness of breath can be due to a lot of things, but both of those, typically, will evoke some type of diagnostic strategy. A patient may have a chest x-ray, as you said, and if there is something that does not look quite right on the chest x-ray, oftentimes the next step is a CAT scan or a CT scan of the chest. The imaging is a little bit better than an x-ray, and so it can detect more specific details than the regular x-ray. Depending on what that shows, if we are talking specifically about lung cancer, there are different spots or dots in the lung that we will either describe as a nodule or a mass, both of which we talked about earlier. A nodule may be a smaller area that does not look normal, a mass may be slightly larger, but both of these in a person who may have some of these symptoms, an appropriate history can certainly raise the concern for lung cancer.

Wilson And if we saw a nodule that was on the edge of the lung, on this CAT scan, and it was small, before you were here on the faculty at Yale, for example, we might try to get a biopsy of that nodule by putting a needle inside the chest, which puts the patient at risk for some side effects from the procedure, but with your expertise, Jonathan, we could attempt the navigation procedure, is that correct?

Puchalski That is correct. When these areas are far outside in the lung closest to the chest wall, we can use either the electromagnetic navigation we recently talked about or something called a peripheral endobronchial ultrasound, or peripheral EBUS. Same type of idea holds for peripheral EBUS in

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that there is a very tiny ultrasound that goes far out into the lungs to help localize where this nodule or this abnormal area is. We can then take the bronchoscope, again, and know that we are actually within this area by ultrasound or by EMN, and then perform the biopsies. The benefit of going from inside through bronchoscopy is that there is a lot less risk of complications. There is something called a pneumothorax, and this is fairly easy to understand when you think of the lungs like a balloon. If you place a needle by a balloon, the balloon can pop. So, that is what can happen, perhaps, 20% or more of the time when we use a needle from the outside of the lungs going through to biopsy these areas. With the emergence of EMN and peripheral EBUS, we can still go from within the lungs and that risk of popping a hole in the lungs, or pneumothorax, is markedly less, downwards of 1% or 2%, and so it really can make a significant difference. Pneumothorax usually is not life-threatening, but it can cause a person to have to stay in the hospital for a couple of days and have a small tube placed to drain the air as the lung heals up. So, it definitely makes things safer and may prevent some unnecessary complications to help the patient get home the same day.

Wilson What are some of the different types of lung cancer?

Puchalski In general, when we perform biopsies to diagnose lung cancer, a pathologist will look under a microscope at the cells in that area, and upfront they will tell us two main categories. One is called small-cell lung cancer and the other is called non-small-cell lung cancer. Within the non-small-cell lung cancer group, there are several varieties; for example, there can be an adenocarcinoma, a squamous-cell carcinoma, a large-cell carcinoma, or some other variants, but the pathologist can tell us, specifically, by looking under the microscope, what a patient has, and by knowing what the patient has, that can help us direct specific therapies for the particular patient.

Wilson I see. Is there a genetic link that we know of for the development of lung cancer, and how about the environment? Obviously, everybody has heard about smoking as a risk factor for lung cancer, but do we know more about genetics now and their relationship to lung cancer, and what are some of the other environmental exposures that could put patients at risk?

Puchalski You are absolutely right. Smoking, hopefully by now, is known by everybody to be directly linked to lung cancer. We are learning more and more about the fact of second-hand smoke. So, if you are around others who smoke a lot, that may also be a risk. There are some other environmental exposures that can be linked to cancer. The genetics of it is becoming more and more understood as we go. It is actually a very, very exciting time for medical oncologists or oncologists that treat lung cancer with chemotherapy, because we are finding different genetics, or mutations in genes, that were not discovered until recently. The importance of this is that I can use some of my tools to get some tissue, but we can look under the microscope, see the general type of lung cancer, so small or non-small and various variants, but then go even further and look at a molecular genetic level and detect some mutations that may be present within the cancer cells themselves. Those mutations then can help us direct even more specific chemotherapy or other therapies specifically

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at the lung cancer that the patient has. We are calling this more an era of personalized medicine where it is not just a matter of "Oh, you have lung cancer", it is "you have this specific type of lung cancer, and therefore we can offer you, specific treatment." That is actually very exciting for this field because with more information, we are able to provide better care for patients.

Wilson Tell us a little bit, Jonathan, about how you are involved in following a patient who is at high risk for lung cancer, or a patient with Barrett's esophagus, for example? Tell our listeners what that is and, obviously, there are x-rays and CAT scans we can do, but with all of the tremendous expertise that you have with these minimally invasive procedures, we are able to actually look on the inside and get a closer look at the linings of the airways. What sort of patients do you follow and how do you do that?

Puchalski Oftentimes, as we have discussed, the patient may have a chest x-ray, a CAT scan, and then need some further diagnoses. We may be able to follow patients based on their CAT scan and not necessarily every abnormality that is detected on a CAT scan needs a diagnosis at that time, we may elect to follow things. We are also at a stage with some of the bronchoscopic tools to detect very, very early stages of lung cancer that would not have been detected without this technology. We have the tools. Confocal microscopy, as you mentioned, is used in Barrett's disease, which often affects the esophagus. In the lungs, we can use a similar VAT confocal microscope, look at the airways trying to detect very subtle changes that cannot be seen with the ordinary eye in that lining, in the mucosa of the lungs, to detect if there is, perhaps, a very early-stage lung cancer. There are other tools called narrowband imaging, or autofluorescence, and an emerging technology called optical coherence tomography or OCT, all of these areas are aimed at going through the bronchoscope, looking at that lining with these tools, and then being able to detect very, very small changes early, and if we can detect lung cancer at an early stage, obviously, we have a much better chance of curing it completely, and sooner.

Wilson We have talked quite a bit about diagnostic procedures, interventions; tell us a little bit about some of the things you do if we have a side effect or a complication from treatment that develops down the road, as an example, someone gets radiation and chemotherapy for their lung cancer and hopefully they are doing well after that, but perhaps they develop a narrowing or a stricture of one of their breathing tubes from some scar tissue that is formed. How would you address that?

Puchalski We can perform therapy now through the bronchoscope, that in this particular case, if there was a very severe narrowing or stricture, there are several options. We could use a very, very small knife within the airways to make some small nicks to make that airway larger. We can use various types of balloons. We can literally expand the airway from the inside to increase its caliber. Whenever we increase the diameter of the airway, more air can flow through that airway, significantly, more air can flow through it, and so a patient's shortness of breath may improve significantly. If those do not work, ultimately, we could do things such as place a stent within the airway. A lot of people may have heard of stents in coronary arteries for patients who have things such as a heart attack, but we can actually put stents within the airways to help keep these areas open. It may be

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after a patient is completely cured from their cancer, and they can have the narrowing. We could place stents in there and patients immediately notice a dramatic difference in their breathing. We can also place these stents for cancer. If the cancer has grown into the airway and obstructs the airway, we can put the stents in to help keep it open. That is very important to minimize the feeling of shortness of breath.

Dr. Jonathan Puchalski is Assistant Professor of Pulmonary Medicine at Yale School of Medicine and Director of the Thoracic Interventional Program at Yale Cancer Center. If you have questions or would like to share your comments, visit YaleCancerCenter.org, where you can also subscribe to our podcast and find written transcripts of past programs. I am Bruce Barber and you are listening to the WNPR Health Forum on the Connecticut Public Broadcasting Network.