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## **Pulmonary Intervention Program**

**Hosted by:** Anees Chagpar, MD

**Guest:** Jonathan Puchalski, MD, Associate Professor of Internal Medicine

April 28, 2019

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*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 pulmonary interventions with Dr. Jonathan Puchalski. Dr. Puchalski is an Associate Professor of Internal Medicine and Pulmonary Critical Care and Sleep Medicine at the Yale School of Medicine, where Dr. Chagpar is a Professor of Surgery.*

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Chagpar        So, Jonathan, maybe we can start off by talking about what exactly does an interventional pulmonologist do, especially with regards to cancer?

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Puchalski        Sure. So, interventional pulmonary is a sub-specialty in internal medicine and pulmonology. We go through an additional year plus of training that focuses a lot on procedures, advanced both diagnostic and therapeutic procedures, and in our line of work, we may work with a lot of patients who have various types of cancer to provide assistance with both diagnosis and treating symptoms oftentimes.

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Chagpar        So, tell me more about that. So, presumably because you are in the pulmonary field, these are patients with lung cancer or cancers that may have gone to the lung from other spots in the body. What exactly does that look like in terms of diagnosis. I mean, many people when they think about diagnosis of something, they think about imaging with CT scans or chest x-rays or what have you and then biopsies. Tell me how an interventional pulmonologist kind of comes into that mix and what the interplay is between you and rest of that multidisciplinary team?

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Puchalski Sure. It is definitely a multidisciplinary team. We become involved through various routes. We often get referred either through patient's primary care physician or perhaps another pulmonologist who does not do the procedures that we do. Similarly, we become involved with referrals from our own colleagues in thoracic surgery, medical and radiation oncology, and so, it generally patients tend to come to us after they have had the imaging that you described, whether that is a chest x-ray or usually a CT scan or CAT scan of the chest that shows something that is not completely normal. And then, our job is to find out if that abnormal finding is or is not cancer and how far perhaps it has spread if that is the case and if it is from the lung or if it is from another area in the body.

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Chagpar And how do you do that exactly?

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Puchalski Oftentimes, it is through bronchoscopy. So, oftentimes, it is actually going into the lungs, sometimes it is going around the lungs and what is called the pleural space where pleural fluid may build up in the form of effusions. So, something within the chest and either that is through bronchoscopy when we need to go inside the lung or a pleural procedure like thoracentesis when we go around the lung.

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Chagpar So, with bronchoscopy, that is where you take a tube and you put it down somebody's throat into their windpipe and you look down into their windpipe into their lungs?

03:58.900 --> 04:24.700

Puchalski Correct. So, it is very similar to, people are probably more familiar with colonoscopies. So, a similar concept, just a different area and as you said, while patients asleep usually with anesthesiology, we go down into the lungs, into the windpipe and we can go to different parts of the lung through the bronchoscope.

04:24.700 --> 04:58.300

Chagpar And then, say somebody has a cancer. Is it often invading into that windpipe like that you can see it in the windpipe or do you have to, if it is not in that windpipe, if it is in the parenchyma or the actual part of the lung that is not necessarily attached to the windpipe, how do you get a sample

because when you were talking about kind of helping to make that diagnosis, figuring out is this cancer, what kind of cancer, where did it come from, presumably you are going after tissue?

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Puchalski        Correct.

04:59.700 --> 05:03.900

Chagpar        So, how do you do that?

05:03.900 --> 06:04.700

Puchalski        So, if you think of the lungs like a tree, we start at the biggest trunk of the tree and then go to different branches. Sometimes, these abnormalities are in those branches or in the airway itself. Sometimes, they are more where the leaves of the tree would be or in the what we call lung parenchyma. And depending on that, depends on what technique we use. So, yes, sometimes a cancer or a tumor or a benign or noncancerous lesion can grow into an airway, in which case we often see that with the actual bronchoscope, but sometimes, we have to use advanced technology to go beyond that airway, go farther out into the "tree per se" to find the areas that we need to make a diagnosis of, and so we can use advanced tools for that.

06:04.700 --> 06:16.900

Chagpar        Tell me about those advanced tools. What is out there? Because some people may understand the concept of bronchoscopy but may not know all of the newer advances that have come down the pipe.

06:16.900 --> 07:04.000

Puchalski        Sure. Bronchoscopy has changed dramatically over the past decade and continues to change actually at a very rapid pace. For the tumor that we may be able to see within the airway, there are different ways to biopsy that so that we can make sure we understand what is going on. But if the tumor is not something that we can see, the different tools include the use of actual ultrasound machine that is embedded within the bronchoscope as well as in the future what looks like it is going to be involving robots and robotic bronchoscopy to assist with making a diagnosis.

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Chagpar        So, you know Jon, we talked on this show a little bit about robotic surgery and how at least in the operating room now surgeons are able to use robots that kind of give them a little bit more dexterity in terms of getting into tight spaces and resecting things. How exactly does a robotic bronchoscope and do we have that now or how long in the future do you think that is going to be?

07:33.000 --> 10:41.800

Puchalski        So, when we try to find areas in the lung that we cannot see, sometimes going back to the tree analogy, it is like trying to find an acorn in the far branches of a big tree. Our current tools actually use different things like an ultrasound. We can put a very, very, very tiny ultrasound machine out into the branches of that tree or the branches of the lung to try to find that tumor or that acorn per se. And if the ultrasound can detect it, we know that that is where we need to do the biopsies. But sometimes, it is not that straight forward. We cannot just go down the branch and find that area. So, we need to make different turns, different twists and more or less navigate to the area. So, currently, we have bronchoscopy tools that are very similar to GPS systems, literally we can correlate a patient's CAT scan to the imaging we talked about earlier with the bronchoscope and we can use these together during a procedure to find the area of question. And literally, it is like GPS, it will tell us go right, then go left, go left again and we end up ultimately hopefully in the area of concern. That technology still is, however, not perfect, it has some shortcomings and the hope for the future is that using robots may improve our ability to make the diagnosis. So, the robots allow us as the lung doctors to use something that is very similar to a video game control, in which case we can advance the robot's arms per se to different areas of the lungs and different parts of the airways to perform the biopsies that we need to. Are they in existence -- they are just coming into the existence. One company was recently FDA approved and another one is expected to be approved by the FDA in the next month or so. And so, I have had the opportunity to work with fine tuning some of those instruments and to see both of those robotic platforms per se, and we hope that within the next 6-12 months, we will have even more information about how good they are -- if they are as good as we think they are going to be, in which case, we likely would have them here within the next similarly 6-12 months.

10:41.800 --> 11:03.000

Chagpar        Well, that's really cool. So, but right now, if there is an acorn out on a far-reaching branch of a tree and you do not really have the ability with your bronchoscope to get all the way out there even with ultrasound, what are the other options? I mean, does somebody just live with an acorn in a tree and not know what it is?

11:03.000 --> 12:26.200

Puchalski        So, sometimes they can. If it is just a very small dot per se, it may be something that we follow with another CAT scan in the future or another series of CAT scans to make sure that it is not growing. If it is something that is a bigger dot and something that we are worried about and we know

that we need to find out for sure what it is, there are still different techniques available. So, one of those with that same "GPS system" we talked about, with that system, it goes beyond the ultrasound, again the turn right, turn left, turn left approach, but it also allows us to obtain biopsies from the outside of the person's body into the lung, we call that a transthoracic biopsy. So, during one procedure, we may be able to perform the whole bronchoscopic approach and if we still do not know what is going on, we may be able during the same procedure using these advanced systems be able to perform biopsies across the chest. So, that is one way of doing it.

[12:26.200 --> 12:44.900](#)

Chagpar In that way, is the patient still in the CT scanner, like you are getting the images and then directing your needle while they are in CT with the radiology doctor or is this is something that happens in a bronchoscopy suite with a pulmonary doctor?

12:44.900 --> 13:04.900

Puchalski So, what I was referring to was actually in the bronchoscopy suite with the pulmonary doctor. So, using that correlation of the CAT scan and the bronchoscope, there is just an extension per se of that technology that still allows us to use the CAT scan that the patients already had.

13:04.900 --> 13:08.500

Chagpar Right. So, they are not getting a new CAT scan while they are on the table?

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Puchalski Not while they are on the table. We do have them get one the same day so that we have the most up-to-date information, but while they are on the table, we can use that CAT scan and this GPS-like system to actually do the biopsies then.

13:26.000 --> 13:44.500

Chagpar Well, that's really cool. You had mentioned that there is another way to access these far-reaching lung nodules, but we need to take a short break for a medical minute first. So, please stay tuned to learn more information about pulmonary interventions with my guest, Dr. Jonathan Puchalski.

13:44.500 --> 14:03.800

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14:50.900 --> 15:53.900

Chagpar        This is Dr. Anees Chagpar, and I am joined tonight by my guest Dr. Jonathan Puchalski. We are talking about interventional pulmonary medicine, and for those of you just joining us, this is really a field where specialized lung doctors can use fancy techniques to help the multi-disciplinary team in both diagnosis and treatment of cancers presenting in the lung whether they come from the lung or they come from other places. Now, Jon, before the break, we were talking about thinking about the analogy of the lung like a tree, which is, I love that analogy because when you think about going down through the main airway, kind of like going up through the trunk of the tree, trying to get some of those far-reaching nodules that may be like acorns in branches of trees can be sometimes a little bit difficult. Now, you had mentioned that there is another technique, another card up your sleeve in terms of biopsying those, how do you do that exactly?

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Puchalski       Well, so, we had previously discussed using ultrasound and GPS-like techniques, we often will rely also on our colleagues in these circumstances to help with those biopsies. So, sometimes, if it is not something that we can access very readily by going through the trunk of the tree, etc., and we have to do biopsies from the outside of the chest to the inside, we work very, very closely with our interventional radiologists who can do CAT scans during the procedures to help biopsy these nodules per se, or we may also need to use our colleagues in thoracic surgery to take out these nodules to figure out exactly what is going on. But we tend to start when possible with the bronchoscopy approach because there are so many different tools that we have available, not only to figure out what is going on but also to potentially figure out if it has spread anywhere else within the chest.

17:04.700 --> 17:42.400

Chagpar        Yeah. And so, one would think that you would like to start with a scope test because it is least invasive, but sometimes these may be near vital structures, big blood vessels and other things that might be a little bit tricky for people to biopsy just with a needle from the outside and you might

need a surgeon who is there who can see these vessels and take this out. The other thing you had mentioned was that interventional pulmonary medicine plays a role not just in diagnosing these lesions, but also in treatment. Tell me more about that.

[17:42.400 --> 18:29.800](#)

Puchalski        So, we do, there are sometimes when a person may have a cancer or something else that has grown into that trunk of the tree like we talked about, something actually within the airways or within the branches, and if those branches are blocked off per se like a tube gets blocked off, the person may have trouble breathing, may feel short of breath, may feel that they cannot get through their normal activities during the day because they are just limited, they cannot catch their breath and that may be because of this tumor or cancer that is growing into the airways, so part of our field does therapeutic bronchoscopy or provides through the bronchoscope.

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Chagpar        How exactly does that work? I mean, one can imagine that, you know, if you take your bronchoscope and if this airway is kind of blocked with tumor, you can kind of try and navigate a little tiny window where the tumor might not be to get your scope down and that might provide a little bit of relief during that procedure, but how do you maintain that when the patient goes home after the bronchoscope?

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Puchalski        Sure. So, if that tube is blocked and we open it up, there are still things that we can actually do during the procedure to help keep it open. We often refer to it as a fire and ice. So, the fire part of that has to do with using tools like lasers or something that we call APC, which is a way to generate heat or generate almost electricity inside the airway that can more or less burn these cancers, burns these tumors away from the airway, and so, not only can we open that up right away but by applying the "fire" to this area, it tends not to grow back at least for a considerable period of time.

19:49.700 --> 20:07.900

Chagpar        So, one question I have right off the bat, I mean, I remember being in girl scouts in remembering how fires get started with heat and oxygen, this is bad combination, and you are telling me that you are putting the two of them together in the airway?

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Puchalski        So we do. Oxygen of course is essential for us to breathe, but we can limit the amount of oxygen during these procedures. There are criteria, there are rules that we follow, so we do not give

more than what we call 40% oxygen during a case, in which case we minimize any risks involved with oxygen. But you are absolutely right, the oxygen plays an important part of the fire, but we are able to control that part when we do the procedure.

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Chagpar           And so, people can have this, this ablation with this heat and not worry about their airway catching fire.

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Puchalski        Absolutely.

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Chagpar           Okay. This is good. I just wanted to allay people's fears in case people were listening to the news about forest fires and things like that. Okay. So, that is the fire part of it, tell me about the ice part of it.

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Puchalski        So, ice is something we call cryo or cryotherapy and we are doing the exact opposite -- instead of using our different tools to burn these tumors and get rid of them that way, we can use cold to freeze them, and because when you freeze a tumor and then let it thaw and freeze it again and let it thaw, freeze it and let it thaw, it cannot survive that, those episodes of extreme cold with normal temperature. And so, we use this cryotherapy in these cases to provide a similar type of relief for obstruction in the airways.

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Chagpar           So, you know, when I think about things freezing and I think about forming an ice ball. Does this actually, you know, if you freeze something, can it obstruct the airway as you create an ice ball or how do you get around that?

22:05.600 --> 22:36.300

Puchalski        So, usually the airway is already obstructed. So, we are taking part of that ice and chipping away at that ice and making it smaller and smaller and smaller each time we were in doing the procedure. So, literally, it is like breaking down parts of an iceberg per se. We chip away at it until it is

gone. So, we do not obstruct it more, we actually shrink it by pulling off pieces of the frozen part one at a time.

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Chagpar           And so, how many procedures do people need to go through in this freeze-thaw, freeze-thaw, freeze-thaw cycle until they can get some relief?

22:46.000 --> 23:31.200

Puchalski        We do during the same procedure and it actually tends to be pretty quick. We can usually do this under half an hour and for really concerned that the tumor, the cancer may grow back quickly and cause a similar type of problem in the near future, we have other technology and techniques that we can use such as putting in stents in the airway, airway stents to keep it open. So, we typically just do either one of these heat or cold therapies and then for concerned we may put an airway stent in to keep it open afterwards.

23:31.200 --> 23:56.200

Chagpar           And how do you decide whether you are going to go hot or cold? I mean, they both sound like they get rid of the tumor, both sound like they open up the airway, both sound like they are relatively safe simple procedures that can be done by an interventional pulmonologist. How do you decide on this patient I am going to use heat and on this patient I am going to use cold?

23:56.200 --> 24:52.300

Puchalski        Yeah, that is a great question. They are safe procedures in experienced hands, so with the right person doing the right procedure, it is safe. Some of our decision making is actually dependent on where the tumor is. So, sometimes we can reach areas better with one technique than we can with the others. Sometimes, when we are investigating this, some tumors appear to respond better to the cold than the heat and so, it depends on the type of tumor, where it is, what else is nearby as you mentioned the blood vessels, etc., and so there is a lot of planning that we do ahead of time to choose the right thing, although most of the time these days, we use the heat methods to facilitate this.

24:52.300 --> 25:22.800

Chagpar           And just thinking about this, so you are either burning this tumor or you are freezing this tumor, but either way, the tumor is still kind of there although it may have died, but you never know for 100% certain that every single cancer cell died. So, how do you decide when you are going to one of these hot-cold methods to get rid of the obstruction versus surgery to kind of just remove it. Is it possible to remove these tumors that are invading an airway?

[25:22.800 --> 26:34.800](#)

Puchalski        It is. And a lot of that will depend on what stage the tumor is in. So, if it is an earlier stage and surgery is an option, that would be the preferred approach because then they can get rid of all the cancer cells. Sometimes, the cancer is too advanced and/or the person may be too sick to undergo a surgery, in which case we are really trying to what we call palliate but really focus on relieving the symptoms of that tumor, so not necessarily completely curing it but really allowing the person to breathe better, get back as close to their normal self as possible in terms of what they are able to do. So, surgery is an option for some, this approach is an option for others. Usually, when we are doing that approach, we are also thinking about what the patient is going to do in terms of perhaps receiving chemotherapy or radiation therapy, and so we work very closely with our colleagues in oncology.

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Chagpar        And tell me more about interplay in terms of chemotherapy and radiation and how that works in the setting of these interventional pulmonary procedures?

26:45.100 --> 27:11.400

Puchalski        So, during the procedure, it is usually the interventional pulmonologist who is doing it, but before the procedure, we will talk to either the surgeon or the medical oncologist, the radiation oncologist, so that everybody is more or less on the same page and we know that we are doing everything possible to treat the patient, both during the procedure, before the procedure and then after the procedure.

27:11.400 --> 27:24.900

Chagpar        So, kind of the sequencing of things right? Do you do chemo first and then do this ablation and then do radiation afterwards or in a different order or in a different mix?

27:24.900 --> 27:40.000

Puchalski        Yeah, it can vary depending on how symptomatic the patient is, what type of cancer it is and what all the therapeutic options are. And so, having that team to work with is really important.

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Chagpar        In terms of the stents that you were talking about, I can think that that would be really helpful just in terms of holding that airway open because when you obstruct, then I can just imagine what it feels like not to be able to breathe, and having, you know if you cannot get rid of the cancer completely, just getting rid of as much as you can and having something that is going to hold that airway

open so that you can breathe would be such a tremendous relief, but what is that feel like for the patient, I mean does it feel like you have something in your airway? And then my second question is, can that obstruct too?

[28:18.900 --> 29:12.300](#)

Puchalski Yes, so these are great questions. A lot times, the patients just get used to it, so at first, they may feel like they have something in their airway and may cough a bit, but being able to breathe again is such a better feeling that the cough may seem more of a nuisance than anything else. We can at times be concerned that the stent may reobstruct. We use different things to help keep them open. So, we use what is called nebulizer machines to give medicines that go directly into the lungs that help prevent mucous for example from plugging it up or clogging it up and there are other techniques we can use.

[29:12.300 --> 29:14.900](#)

Chagpar Does the cancer ever regrow into the stent?

[29:14.900 --> 29:32.400](#)

Puchalski It can. If it does, then we can also go back to what we did before in terms of the fire and ice therapy and perhaps treat it that way or if needed, use a longer type of stent in those scenarios.

[29:32.400 -->](#)

*Dr. Jonathan Puchalski is an Associate Professor of Internal Medicine and Pulmonary Critical Care and Sleep Medicine at the 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.*