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Endobronchial Ultrasound-Guided Transbronchial Needle Aspiration

ENDOBRONCHIAL ULTRASOUND-GUIDED TRANSBRONCHIAL NEEDLE ASPIRATION

You are listening to ReachMD XM 160, The Channel for Medical Professionals. Welcome to Medical Breakthroughs from the University of Pennsylvania Health Systems with your host, North Western University Internist, Dr. Lee Freedman.

How are physicians using a new minimally invasive technology to stage lung cancer and diagnose other lung masses? Joining us to discuss endobronchial ultrasound-guided transbronchial needle aspiration with Dr. Andrew Haas, Assistant Professor of Medicine in the Pulmonary, Allergy, and Critical Care Division at the University of Pennsylvania Medical Center.

DR. LEE FREEDMAN:

Welcome Dr. Haas.

DR. ANDREW HAAS:

I am happy to join you today.

DR. LEE FREEDMAN:

You know when I think about a bronchoscopy, I think you are looking you are getting an exact visualization. What advantages are there to incorporate ultrasound and how is this done?

DR. ANDREW HAAS:

Yah, it's a very interesting question. So for the period of time the bronchoscopy has been around when flexible bronchoscopy initially was invented and introduced into United States it was in the late 1960s, and from that period of time really until approximately 2 to 3 years ago bronchoscopy occurred just as you mentioned it. So, you basically have your light and your camera on the end of your scope, you drive through the airways, and using CT scans and other imaging modalities we try to make an educated guess in many respects as to whether abnormalities are that we wish to biopsy, and particularly when we are talking about transbronchial needle aspirations it's the

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lymph nodes and/or masses that are adjacent to the main airways, and so you could imagine as I like to explain it to my patients a bronchoscopy is kind of like having a scope in the middle of the garden hose, we put scope inside, but we cannot see anything outside and that's kind of how we would do bronchoscopy before ultrasound. However, with the advent of developing ultrasound it's very similar to the fact of once again as I explain to my patients when a woman is pregnant, you can't see the fetus in her abdomen, however, you put the ultrasound on her belly you can see everything. So when we have the ultrasound probe in the airway, we place the ultrasound probe adjacent or right against the airway and now we can see all the lymph nodes, we can see the blood vessels, we can see the lung parenchyma, we can see the entire anatomy of the chest, and then utilizing that visualization then advance a needle through the airway wall directly into the lymph node while at the same time avoiding all of the major blood vessels, avoiding other structures in the chest you may not wish to stick the needle into, but for ultrasound, as I mentioned, when you are just doing CT guidance, you basically did this somewhat blindly and there was not infrequently where you stick a major blood vessel and have bleeding, and while the bleeding was never often a major complication, it certainly has been reported that without ultrasound guidance the major bleeding and complications could occur related to blind-needle aspirations.

DR. LEE FREEDMAN:

Boy that certainly makes sense and would this cut down on the number of biopsies that you would do prior to ultrasound technology?

DR. ANDREW HAAS:

Absolutely and that's very kind of an area of evolution right now as to how many needle aspirations are needed, and so generally the larger the lymph node is that we can localize with the endobronchial ultrasound get into a nice mini area so to speak of the lymph node that looks abnormal on her ultrasound imaging place the needle with on-site evaluation, which is a nice development that also come along. We take a needle pass, that needle pass goes directly to our pathologist in the bronchoscopy suite. They smeared on the slide. They looked underneath the microscope at the sample we just obtained and they can tell us right there, yes you have a diagnosis or no you don't, you need to take another pass, and so ultrasound in combination with the on-site evaluation definitely minimizes the number of passes we have to take, which minimizes the length of time for the procedure for the patient, it minimizes the amount of sedation that they have, and it minimizes probably the number of complications it can develop in the long run.

DR. LEE FREEDMAN:

Boy what a huge step forward. Now the actual technology, has this been a difficult thing to develop to get something that will work along with bronchoscope and give the ultrasound images?

DR. ANDREW HAAS:

Yes. There are two main things that have limited it in the development within the chest and the lung and a bronchoscopy. One is the fact that ultrasound works by sound waves and so you have to have actually a solid medium in order to have sound waves propagate through the chest and so gives a simple way to think about it when you and I talk over a distance, you are not going to hear me a mile away, but are the million colleagues that live in the water whales and dolphins can communicate over miles because the water is a solid medium. In the original development of ultrasound for human applications it was mostly used in the abdomen, used in the soft tissues where we have solid mediums, which allows the sound waves to go out and come back, where you could imagine if we are trying to do that in the lung you have got air everywhere.

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DR. LEE FREEDMAN:

Right.

DR. ANDREW HAAS:

So, they had to somehow solve that problem and the way they solve that problem was to develop balloons to go on the end of the ultrasound probes that then gets filled with the saline solution, and so when the balloon blows up its filled up with saline, it allows for the balloon to touch the airway wall, which now gives you what we call ultrasonic graphic coupling, which means now the sound waves can go from the probe through what used to be air, it is now the balloon with saline, and now we can see the lung outside of that. The second major kind of obstacle was the fact that bronchoscopes are pretty small. So, the airway itself is probably undulated about 14 to 18 mm in most people. So, bronchoscopes can't fill that host space and most bronchoscopes are about 5 to 6 mm in size, and so similar to look at all the other technology around this over the last couple of decades, they keep getting smaller and smaller and smaller and smaller. They had to wait for the technology to get to the point where ultrasound technology was small enough to fit into a bronchoscope. So after those two main developments solving the air problem and solving the size problem are developed, it was not until a last, you know 3 to 5 years as I mentioned that we have this available to us.

DR. LEE FREEDMAN:

And in with regard to the first problem, is there a limit in terms of how deeply into the lung away from the bronchus that you can see because there is air in the alveoli?

DR. ANDREW HAAS:

Absolutely, there are really two different probes that have been developed. One is what we call a central probe and then there is a peripheral probe and so the central probe is the one that the balloon on it and that allows you to see you blow the balloon up with the saline, you can see around circumferentially all of the lymph nodes, the blood vessels, and so forth. When we get out further into the alveoli with the use of very small balloon probe or a peripheral probe, when you get out to that point, basically what you see is all of the air and is what we call the snowstorm affect and just looks like you are driving through a snowstorm. However, if there is a small mass or a nodule farther out in the lung parenchyma and you get the probe near that, the snowstorm goes away and all of a sudden you see something solid and then you can mark that spot with special markers that we have to then allow you to go, you take the probe out and you can go back in with your biopsy forceps, your brushes, and so forth in order to get a sample for a diagnosis.

DR. LEE FREEDMAN:

If you are just tuning in, you are listening to Medical Breakthroughs from the University of Pennsylvania Health System on ReachMD, The Channel for Medical Professionals. I am your host, Dr. Lee Freedman, and with me today to discuss endobronchial ultrasound-guided transbronchial needle aspiration is Dr. Andrew Haas, Assistant Professor of Medicine at the University of Pennsylvania Medical Center.

So, Dr. Haas that's the theory behind it and very interesting how it developed. What are the practical applications of this technology?

DR. ANDREW HAAS:

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Yes. So what we were primarily using it for and what has been extensively studied in its development in the last 3 to 5 years is really for lung cancer. You know lung cancers are unfortunately well it's not the most common cancer in the United States, it's the most fatal cancer in the United States and in the developing world, and so what we tried to do is determine, which patients are going to be eligible for surgery and which patients will not be eligible for surgery. We certainly would want to operate on a patient who has extensive lung cancer if we can identify without putting them through an invasive procedure. So, what EBUS-TBNA has allowed us to do is localize these lymph nodes in the middle portion of the chest, and if we can do an EBUS-TBNA, find that the cancer has spread to the lymph nodes we then say that patient from going forward with surgical procedure that wouldn't be indicated. Traditionally, these lymph nodes were biopsied with the procedure called mediastinoscopy, which is when they make a small incision in the neck and then dissect down on top of the trachea to find the lymph nodes. In general that is a fairly safe procedure, however, does often require an inpatient hospitalization overnight and there is about a 2% morbidity risk and about a 0.1% mortality risk. With the EBUS-TBNA, it's the same-day procedure. The patient goes home, you know 2 to 3 hours after our procedure and there has been really minimal reports of any type of complications from this procedure because once again we are visualizing what we are doing. So, the studies that have been done have basically shown that in experienced hands and as I said this is a relatively new technology so for lot of people that experience is still evolving, but in those people that have had the technology and done the studies from the beginning, it really has the same ability to recover the lung cancer and stage lung cancer just like mediastinoscopy, and so in some centers did actually has replaced mediastinoscopy for lung cancer staging.

DR. LEE FREEDMAN:

What a major step forward. Lets say you are doing this and you biopsy a node its negative, how many additional biopsies are typically done in other areas of the mediastinal nodes?

DR. ANDREW HAAS:

It's we generally do what we call mapping, and so we know based on previous CT scans where the lymph nodes will be sitting, and so we will just go from lymph node station to lymph node station along the windpipe into the space underneath the trachea, the subcarinal space to the hilum, and so we just kind of march our way along through all of those lymph nodes until we sample them all, and if they all turn out to be negative, then we have staged that patient as not having cancer in the those lymph nodes and they would go ahead, see a surgeon and proceed forward with surgical resection.

DR. LEE FREEDMAN:

Is this technology also applicable to other masses or other adenopathy, Hodgkin's versus sarcoid those type of things?

DR. ANDREW HAAS:

Excellent question. So, the nice part about this is that the samples that we obtain with the needle are actually fairly sizable and so there is often times the patient as you mentioned with sarcoidosis or lymphoma or even some infections that can involve the lymph node to the chest, as long as we can see them with the ultrasound and can obtain a sample, we can make the diagnosis, and so sarcoidosis there has been studies evaluating, looking at using EBUS-TBNA, and its as good also once again as mediastinoscopy and obtaining a diagnosis. For the patients with lymphoma, most lymphomas can be detected. The one exception I would say is the Hodgkin's disease because a lot of the lymph node in Hodgkin's disease tends to be very fibrotic with lots of scar tissue in it. Because of that nature, the needle just can't cut the lymph node and get good samples in order to obtain a diagnosis. So that would be the one exception of a lymphoma where we often do miss the diagnosis and the patient does have to proceed forward with surgery, and on occasions we are able to a rare insistences of tuberculosis or other infections and involve the lymph nodes, we obtain a sample with the EBUS-TBNA, we can send back for appropriate culture analysis and obtain infectious diagnosis as well.

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DR. LEE FREEDMAN:

Are other interstitial lung processes where you would like to get into a particular area, is that very amenable or that's not for this technology?

DR. ANDREW HAAS:

Right. So this technology mostly used is the EBUS-TBNA specifically because looking just for the midportion of the chest, the lymph nodes, the masses that are against the main airways, the trachea, and the mainstem bronchi, when you can get out into interstitial lung disease where it's involving the parenchyma of the lungs, we wouldn't use this type of an ultrasound scope, we would use the peripheral ultrasound probes that I had mentioned previously. Sometimes patients with interstitial lung disease will have enlarged lymph nodes that were suspicious of, and in that instance we would use the EBUS-TBNA to sample those lymph nodes and then use the peripheral ultrasound probe to find areas to get biopsies for the interstitial lung disease.

DR. LEE FREEDMAN:

I would like to thank Dr. Andrew Haas, Assistant Professor of Medicine in the Pulmonary, Allergy, and Critical Care Division at the University of Pennsylvania Medical Center for talking to us about endobronchial ultrasound-guided transbronchial needle aspiration, a new technology that is already very useful diagnostically and has some potentially very exciting therapeutic usage in the near future, very exciting stuff. Thank you very much for listening.

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