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Innovations in Lung Cancer Diagnosis and Surgical Treatment

Announcer:
Welcome to CME on ReachMD. The following CME activity is provided by TOPEC and the Roswell Park Comprehensive Cancer Center through the generous support of BlueCross BlueShield of Western New York.

Dr. Hennon:
Hello, I'm Mark Hennon, and I'm a thoracic surgeon at Roswell Park, and today we're going to be talking about innovations in lung cancer diagnosis and the surgical treatment of lung cancer.

The objective of today's talk will be to provide an overview of the importance of screening for lung cancer as well as to briefly describe recent developments in the diagnosis and surgical management of lung cancer.

When talking about lung cancer, we must first take note of the burden of a disease that it is in the United States. There's an estimated 222,000 cases diagnosed in 2017, and lung cancer accounts for 13.2% of all cancer cases. It's a very lethal form of lung cancer, accounting for almost 156,000 deaths in 2017, and all told it accounts for almost 26% of all cancer deaths.

When talking about lung cancer, it's important to note of how the stage that a patient is diagnosed with at the time of their diagnosis truly impacts their long-term survival. This is a chart that is called a survival curve that shows that a patient's long-term survival is dramatically reduced when diagnosed at a higher stage of disease, so the top line being a patient diagnosed with stage I has a much higher percentage of being alive in 5 years compared to the lower curves, with each line moving downward being a higher stage of diagnosis, and so this really helps point out the fact of how important it is to make improvements in being able to diagnose patients at an earlier stage of disease.

One of the ways that we can hopefully diagnose patients at an earlier stage of disease is by performing lung cancer screening. The effectiveness of lung cancer screening was examined with the National Lung Screening Trial, and this was the largest cancer screening trial that had been performed to date, and it was reported on in 2011. This was an NCI-sponsored trial, and it compared screening patients for lung cancer with low-dose CAT scans compared to screening patients with standard chest x-rays. Patients were randomized to either arm with standard of care follow-up. Patients had a total of 3 annual low-dose CT scans during the trial, and this trial was performed at over 30 institutions in the United States. When the results were reported in 2011, basically what was seen was that screening with low-dose CAT scans improves overall survival. In other words, 354 patients who were screened with CAT scans died during this trial compared to 442 patients who were screened with standard chest x-ray, so 88 patients who were screened with CAT scans did not die compared to those screened with chest x-rays, leading to an overall reduction or improvement of 20% mortality for lung cancer.

When diagnosing and evaluating a patient with lung tumor and beginning the process of diagnosing or working towards a diagnosis, and more importantly working towards a stage, there have been advancements in terms of how we can accurately do this. On this slide on the left is a picture of a standard CAT scan image of a patient with a lung tumor in their right lung, and on the left is a representative image of a patient who had undergone a PET CAT scan, which helps with the process of initial evaluation and staging as well. It's important to note that neither of these modalities actually provide a specific diagnosis. When doing that, standard techniques have

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involved performing a biopsy percutaneously through the skin or performing standard bronchoscopy.

Newer advancements in diagnostic techniques have evolved in the past 5 years and involve such techniques as navigational bronchoscopy. Navigational bronchoscopy requires general anesthesia. It can lead to an accuracy of 80%, depending on the location of the lesion of interest, and this accuracy can be improved by adding additional modalities, including endobronchial ultrasound, which I will talk about. Navigational bronchoscopy, as well as being an effective diagnostic technique, is also being developed for potential ablative therapies as well.

Another technique endoscopically that can be helpful in terms of evaluating patients, potentially providing diagnosis as well as providing improved staging in evaluation of lymph nodes, is endobronchial ultrasound. Endobronchial ultrasound basically involves using a special bronchoscope that has a very small ultrasound on the end of the scope that can be used to provide an ultrasound image to assist in looking at lymph nodes as well as passing a needle into the lymph node for sampling it. Radio ultrasound is a smaller scope that has a 360-degree view, which can be driven further out into the lung to assist in biopsying peripheral lung nodules.

Here is a picture of the information that we use and obtain when performing endobronchial ultrasound. On the left is the CAT scan that's used when planning the procedure, and we can see a tumor that is behind the airway in the right lung. In the middle column we see the ultrasound images of what that tumor looks like when pushing the ultrasound scope up against the airway, and we can see, also, the image of the needle with a live view going into the tumor or lymph node when performing the aspiration. This is the sample that the pathologist gets to see in the far right column and can be very helpful in providing or analyzing tumor cells or lymph node cells in terms of staging the patient or providing a diagnosis.

This is a video, a brief video of an endobronchial ultrasound, live video, and you can see the ultrasound image being used to visualize the lymph node, and you can see the needle pass out into the lymph node, at which point suction is applied to draw tissue samples into the needle.

When talking about advancements in the treatment of non-small cell lung cancer, it's important to first just briefly review how the treatment is based on stage. So for stage I disease, it typically involves surgical resection for patients who are adequate candidates. For stage II disease, surgical resection is then volunteered by additional treatments, such as chemotherapy or radiation. For stage III disease, neoadjuvant therapy is performed first, followed by potential surgery. And for patients with stage IV disease, it typically involves chemotherapy or some form of systemic therapy, such as immunotherapy or targeted therapies based on genetic changes in someone's tumor.

When talking about innovations for stage I disease, these primarily involve innovations that have revolved in the surgical world and how we approach resecting lung cancer through surgery, and big advancements have been made in the past 10 to 20 years in terms of minimally invasive surgery. The primary forms of minimally invasive surgery for lung cancer involve thoracoscopic surgery, also known as VATS, as well as performing robotic-assisted surgery through small incisions with the assistance of a surgical robot. Other advancements involve a better understanding of how to approach smaller tumors with lung-sparing surgery, and this involves primarily knowing when to decide and when to perform sublobar resection, being able to do that with segmentectomy, as well as performing complex bronchial and vascular sleeve resections for patients with tumors involving vessels or airways that would otherwise require whole lung resection.

When talking about minimally invasive surgery and VATS lobectomy, it's important to note that this reduces perioperative morbidity compared to standard thoracotomy. It's been shown to facilitate the delivery of adjuvant therapy in terms of chemotherapy. There are potential cost reductions that have been reported with minimally invasive surgery due to reduced length of stay and reduced complications. And previous concerns regarding the oncologic soundness of minimally invasive approaches for lung cancer resections have largely been disproven. Basically, over the past 5 to 10 years, the indications for when to perform minimally invasive surgery have been expanding and now include minimally invasive approaches for tumors that were previously too large, or involved the chest wall, or require a whole lung resection, or for tumors with complex lymph adenopathy that can make a surgical dissection difficult, as well as those requiring airway reconstruction.

This is a video of a minimally invasive resection for a patient's tumor that involves the chest wall and was growing into the ribs. You see it's sped up, but here the tumor and the lung are adherent to the chest wall. The pleura around the tumor and its area of invasion is first scored, and then the soft tissues are divided. The ribs have to be divided with a bone cutter, and this is happening right here. After the ribs have been divided, again, additional soft tissue is divided.

Here is another rib being divided. The rib cutter that was used there was a standard rib cutter, and with the newer surgical technology, you can see a low-profile rib cutter being introduced in this portion of the video that can fit through small incisions and can cut the part of the rib that is further away from the operative incision.

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Here is a burr drill, which instead of cutting the rib, can be used to cleanly dissect and divide the rib in a very clean fashion, and given the length of the drill can be, again, passed through small incisions, preventing the need for thoracotomy.

At this point, the tumor specimen, where it's invading the chest wall, has almost been completely divided. Here are some soft tissue over it as being divided, and the tumor will be extracted out of a minimally invasive incision.

This is a video of a minimally invasive surgery involving complex airway reconstruction, previously felt to be a procedure that could only be performed through standard open techniques, is now being performed with minimally invasive techniques at select centers around the country. Here is the portion of the video where the vessels to the lobe have been divided, and the airway is being cut at this point to safely remove the tumor in its entirety. This portion of the airway being cut is considered the portion going to the part of the lung that is going to remain in the patient, and then another part of the airway will be cut above where the tumor is coming into the airway, and the airway will be sewn back together.

Here are the final cuts preparing the airway to be sewn back together. The specimen is then extracted. And then after cleaning up the edges, individual sutures will be placed again through minimally invasive incisions to sew the airway back and put it back in continuity. Obviously, the video is sped up. The sutures can be tied. And at the end of this image, you'll see some healthy tissue wrapped around the airway anastomosis as reinforcement. Sutures are tied down. This is the healthy tissue involving basically muscle from the chest wall being wrapped around the anastomosis, and here is us checking to make sure it's airtight.

So, when talking about other advancements with minimally invasive surgery for early-stage lung cancer, another area of focus is involved evaluating the appropriateness of sublobar resection or lung-sparing surgery for patients with small lung tumors. Sublobar resection for small peripheral tumors is a controversial subject in itself, and it's clearly reserved for tumors that are smaller than 2 cm and located in the periphery of the lung. There have been 2 large-scale prospective randomized trials evaluating the results for performing sublobar resection. The results of these trials are pending, but in general, in the thoracic surgery community, segmentectomy is generally preferred as an approach given that it's an anatomical dissection resulting in lymph node dissection.

In conclusion, lung cancer screening with an annual low-dose CT scan reduces mortality for patients who are diagnosed with lung cancer. There are effective options for diagnosis and staging of non-small cell lung cancer that are expanding and improving every day. And minimally invasive lung resection for non-small cell lung cancer is safe and improves morbidity.

If you have any additional questions, feel free to contact me at RoswellPark.org.

Announcer:
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