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Minimally Invasive Strategies To Evaluate and Treat Lung Lesions May Improve Cancer Outcomes

At NewYork-Presbyterian Hospital, minimally invasive methods to confirm and stage lung cancer are complementing broad efforts to improve outcomes in the most common cause of cancer death. Many suspicious pulmonary nodules discovered inadvertently or as part of ongoing computed tomography (CT) screening programs once required open surgery for evaluation. Increasingly, minimally invasive strategies being pursued at the Hospital allow sufficient tissue to be acquired to confirm the diagnosis, provide information about the cancer stage, and identify molecular characteristics that may be relevant to choice of treatment.

Minimally invasive strategies are complementary to CT screening programs that have been initiated to identify lung cancers at an early stage in high-risk patients. Although studies suggest lung cancer deaths can be reduced by at least 20% with screening, "the majority of nodules found on CT scans are benign," explained Nasser Altorki, MB, BCh, Chief of Thoracic Surgery, NewYork-Presbyterian/Weill Cornell Medical Center. Dr. Altorki added, "The trick is to avoid invasive procedures or surgery in patients who do not have cancers. New minimally invasive techniques to obtain tissue samples significantly enhance our ability to improve early diagnosis."

EBUS-TBNA

The advances in minimally invasive strategies for sampling potentially cancerous lung tissue are largely derived from progress with imaging to guide needle biopsy. These strategies depend highly on technique to reduce the risk for false-negative results, and investigators at NewYork-Presbyterian Hospital have been leaders in identifying how to optimize diagnostic yield. William Bulman, MD, Director of Bronchoscopy at NewYork-Presbyterian/Columbia University Medical Center, has been at the forefront of an important effort to define optimal technique with endobronchial ultrasound real-time guided transbronchial needle aspiration (EBUS-TBNA).



NewYork-Presbyterian Hospital is implementing new minimally invasive techniques to reduce the need for invasive procedures and surgery on patients without cancer.

"EBUS-TBNA is now being used widely for diagnosing and staging malignancy in pulmonary nodules and thoracic lymph nodes, but the diagnostic yields vary," Dr. Bulman said. "Developing strategies to reduce the risk of false-negative results is an area in which we have developed expertise. We have addressed this in a very regimented way and recently summarized our strategies in a review article," noted Dr. Bulman, referring to an article in the *American Journal of Respiratory and Critical Care Medicine*.¹

The goal is to obtain tissue samples that provide all of the information needed for management of a patient's cancer. While confirming diagnosis of lung cancer is the critical first step, adequate tissue samples are important for characterizing the cancer to provide prognostic information and guide therapy.

"We have characterized strategies that increase the likelihood of obtaining evidence of malignancy to permit more consistent and reliable findings," Dr. Bulman explained.

The importance of adequate tissue sampling has further intensified now that it is clear that the molecular profile of lung cancer is relevant to the individualization of pharmacologic therapies. Most importantly, novel small-molecule inhibitors

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Robotic Applications and Operating Room Technology Are Transforming the Post-Op Surgical Experience

Building on the concept of minimally invasive procedures, robotic surgical approaches performed at NewYork-Presbyterian Hospital are vastly improving the patient experience. Real-time imaging in the operating suite combined with continually advancing robotic systems offer the potential for greater precision with less trauma, less scarring, less blood loss, and quicker healing. Surgeons are driving the advances, and there are programs at both NewYork-Presbyterian/Columbia University Medical Center and NewYork-Presbyterian/Weill Cornell Medical Center that create an environment that encourages their rapid implementation.

“Our surgeons are the ones driving robotic applications. My goal is simply to ensure we are setting up our operating rooms [ORs] to facilitate these innovations,” said John C. Evanko, MD, MBA, who is Medical Director of Perioperative



NewYork-Presbyterian Hospital is improving their patient care by implementing new, advanced robotic systems that help to improve the patient experience.

Services at NewYork-Presbyterian/Columbia and a gynecologic surgeon. Dr. Evanko—whose expertise with the da Vinci Surgical System includes a minimally invasive approach to treat uterine fibroids, as well as other gynecologic surgeries—reported that real-time imaging has been fundamental to creating the modern OR, which is capable of offering minimally invasive endovascular procedures, as well as radiologic-guided interventional, cardiothoracic hybrid, and robotic procedures.

“ORs for minimally invasive endovascular procedures provided a head start because they were set up for real-time imaging and had the structure and size to accommodate the equipment and connectivity that we need for robotic procedures,” explained Dr. Evanko, who works to assist OR innovation at NewYork-Presbyterian/Columbia. “Minimally invasive surgery overall and robotics in particular are now being used effectively across specialties, including gynecology, urology, otolaryngology, and thoracic and general surgery.”

Gynecology

For most of the diseases and conditions in which robotic surgery is now an alternative to an open approach, it is not yet clear whether robotic-assisted surgery necessarily yields better outcomes. This is difficult to prove because of the challenges of performing randomized trials with appropriate controls, but Dr. Evanko said that there are clear advantages for the patient in regard to recovery when robotic-assisted surgery reduces the size of incisions. In gynecology, the da Vinci Surgical System has been part of a movement to achieve minimal scarring and speedier return to normal activities after common procedures, such as hysterectomy and myomectomy.

“The published data that claim better outcomes with robotic-assisted surgery are largely anecdotal and not any more compelling than the data which

suggest that there are no outcome advantages,” Dr. Evanko said. “In my opinion, the jury is still out on whether these surgeries offer any significantly better clinical outcomes over conventional surgery, but the extent to which this approach advances a minimally invasive approach and allows patients to recover more quickly is perceived by patients as a very important advantage.”

Kevin Holcomb, MD, who is Director of Minimally Invasive Surgery of the Department of Obstetrics and Gynecology, NewYork-Presbyterian/Weill Cornell, noted that the benefit of offering advanced robotics technology is to improve patient quality of life while providing similar survival outcomes. Dr. Holcomb is also Associate Attending in Obstetrics and Gynecology at Weill Cornell Cancer Center, and Associate Professor of Clinical Obstetrics and Gynecology at Weill Cornell Medical College.

Oncology

“A major focus for us at Weill Cornell Cancer Center is working to improve the quality of our patients’ lives, leaving them with less morbidity from our treatments so they go on to live fruitful lives without any long-standing detriment. I think in that regard, robotics plays a major role,” Dr. Holcomb said. He added that his team is studying robotic-assisted surgery, which involves the use of the da Vinci Surgical System, in gynecologic cancers other than those for which it has already demonstrated benefit, such as in endometrial cancer. “We’ve been performing many robotic surgeries for recurrent ovarian cancer, and really pioneering this,” said Dr. Holcomb, who instructs other surgeons on the technology. “Recently I was able to debulk a patient’s ovarian cancer robotically. She was rendered in complete clinical remission with a surgery that lasted about 2 hours and she didn’t have to stay in the hospital overnight. I think that is a huge benefit and it isn’t being offered in many places.”

Additionally, patients contraindicated for a minimally invasive surgical approach, such as the morbidly obese and patients with severe comorbidities, also have shown positive outcomes when robotics were employed for surgery. “We’re routinely approaching these patients and doing complete staging with robotic assistance,” Dr. Holcomb said. “Obviously, performing primary abdominal surgery in the instance of big, bulky abdominal disease is problematic, but we are finding that there is a role for robotic-assisted surgery. There is the patient who has an isolated recurrence after 3 years of being disease-free, for example, or the patient who has undergone chemotherapy and whose tumor shrank appreciably—very often, I elect to go back and handle these types of cases robotically. They’re not necessarily getting a survival benefit from it, but there is a huge benefit for quality of life.”

Otolaryngology

It is this patient orientation that has driven the interest of surgeons at NewYork-Presbyterian Hospital since the early days of the movement toward minimally invasive resections. This has produced a proactive approach to developing ORs that can accommodate technological advances, such as real-time imaging and high-definition monitors that display laboratory results and other information relevant to the case. Some ORs incorporate teleconferencing that permits rapid communication

with pathologists or other specialists who might influence decision-making during the course of the surgery.

At both NewYork-Presbyterian/Columbia and NewYork-Presbyterian/Weill Cornell, this type of forward thinking has allowed surgeons across specialties to move quickly into robotic-assisted surgery where appropriate. One example is otolaryngology, where robotic-assisted excision of oral pharyngeal cancer has been in place for almost 4 years.

“Robotic procedures are replacing the major surgeries, which included mandibular resection in order to reach the back of the tonsil to remove these tumors,” said David I. Kutler, MD, Associate Professor of Otolaryngology at NewYork-Presbyterian/Weill Cornell. “With the robot, we can access these tumors through the mouth, without any incisions made to the face, and still do an oncologic procedure to remove these cancers. The time in surgery has been reduced from upwards of 10 hours to about 2 hours; hospitalization has been reduced from 2 weeks to 4 days. Robotic surgery also circumvents the need for chemotherapy and high-dose radiation therapy.”

Orthopedic, Gastrointestinal, Neurologic

At NewYork-Presbyterian/Columbia, robotic-assisted surgery is now being employed for some common orthopedic diseases, for resections of a vast array of malignancies, and for gastrointestinal

diseases, including resections of the bowel. The precision of robotic-assisted surgery has long made it attractive for neurologic applications, but the expansion to such a broad array of organ systems is attributed primarily to its role in taking minimally invasive surgery to the next step. Although the laparoscope brought momentum to minimally invasive surgery, modern imaging systems allow visualization without a scope. It is a new approach that demands ORs with different capabilities.

“Imaging was once a preoperative device to plan surgery,” Dr. Evanko said. “Increasingly, imaging such as CT [computed tomography] scanning is an intraoperative tool to guide the procedure. The modern OR has to be large enough to accommodate the imaging systems, the displays, the robotic devices, as well as the monitoring equipment that would be found in a conventional OR. This requires planning and the infrastructure that allows the OR to function efficiently.” Simply running the wires to an increasingly complex and sophisticated array of devices limits the degree to which the OR can be retrofitted as needs evolve.

“We have been deeply involved in attempting to anticipate these changes and to approach the development of a modern OR with a prospective approach. This has allowed us to stay at the front of the curve in expanding robotic-assisted surgery where it has advantages for the patient,” Dr. Evanko said.

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can now be selected to address activated molecular pathways of proliferation.

“There is an evolving paradigm for lung cancer treatment. Therapy is becoming increasingly personalized on the basis of the molecular profile, and the beauty of EBUS-TBNA is that it is a relatively safe and minimally invasive approach for obtaining sufficient tissue that may subsequently guide therapeutic strategies as well as diagnose the disease,” Dr. Bulman explained.

New Technologies Guide Biopsy

Dr. Altorki has led the effort at NewYork-Presbyterian/Weill Cornell to minimize false-negative results using CT-guided fine needle aspiration. The key strategies that he and his colleagues identified to improve the accuracy of this technique were recently published.² The work in CT-guided fine needle aspiration is part of a larger effort to derive tissue from all pulmonary nodules with minimally invasive strategies.

“Fine needle biopsy is one of several options for minimally invasive procedures to access suspicious lesions. Appropriate technique affects the accuracy of all of them,” said Dr. Altorki, who described protocols to improve the diagnostic yield of fine needle biopsy and ongoing efforts to employ fiberoptic bronchoscopy more effectively. While this tool has long been used to biopsy lung lesions that are visible

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and accessible, the technology is being stretched. One approach is navigational bronchoscopy, which involves computer processing of CT imaging data to guide the bronchoscope to the target lesion.

“The computer processes images of the lung to identify the shortest possible route when navigating the bronchoscope—it is something like plotting a flight plan. This is a very useful technique that not only improves efficiency during the procedure but increases the diagnostic yield, especially when attempting to access distant nodules,” Dr. Altorki said.

In some cases, the site of the lesion is readily reached with a bronchoscope, but the lesion cannot be visualized because it is on the outside of the bronchial tube. In this case, EBUS has been employed to position the scope to facilitate placement of the needle into the target. The real-time sonar images allow precision adjustments of the needle and increase the likelihood of obtaining evaluable cells for pathologic evaluation.

Bottom Line: Several Strategies Exist

Due to the strengths and weaknesses of available options for reaching suspicious lesions in specific locations of the lung, the choice of strategy for minimally

invasive access to pulmonary nodules is made on a case-by-case basis, according to Dr. Altorki.

“If all else fails, we can still consider a surgical biopsy, but this can almost always be performed with minimally invasive techniques. While the goal is to obtain a tissue sample with minimal risk to the patient, it is also critical to select the technique with the lowest likelihood of a false-negative result,” Dr. Altorki said.

In some cases, a combination of approaches is employed. For an example, Dr. Altorki described very small lesions that can be difficult to locate by a minimally invasive technique. In this case, image-guided bronchoscopy can be performed to inject dye at the site of the lesion to ensure that the surgeon can see and access the affected tissue. These types of approaches have a large potential to improve outcomes in lung cancer. Because of the fact that screening CT scans have a high sensitivity but a low specificity for lung cancer, minimally invasive strategies are critical from a benefit-to-risk perspective.

The value of effective but minimally invasive methods of sampling lung tissue has only intensified now that several organizations, including the American

Association for Thoracic Surgery (AATS), have advocated lung cancer screening in high-risk patients, generally defined as men or women older than age 55 years with a 30 pack-year history of smoking. While the screening is a strategy for catching cancers at a stage when they can still be cured, the efficacy of the screening is highly influenced by the diagnostic technique.

“There is a broad array of variables that affect the diagnostic yield, including the expertise of the pathologist reading the tissue samples. Progress in this area may be less immediately dependent on developing new tools for obtaining adequate tissue samples than in correctly using the tools that are currently available,” Dr. Bulman observed.

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