Perspective

Perspectives on robotic pulmonary resection: It's current and future status

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Current status of robotic pulmonary resection

Currently robotic pulmonary resection, as described in the previous chapter by Dr. Parks, is performed in select centers in the United States, Europe, and other parts of the world. It still represents less than 1% of how pulmonary resections are performed, with the main reason relating to the limited platform availability of the robot to thoracic surgeons. A few hospitals have robots, and are mostly used by urologists and gynecologic surgeons. However, thoracic surgeons are using it more frequently. In fact, recent data from Intuitive Surgical suggests that the greatest growth in robotic use over the past year is by thoracic surgeons.

There are several ways to perform robotic pulmonary resections including completely portal robotic lobectomy; meaning only trocars are placed through the incisions. An international writing committee has submitted a suggested nomenclature for robotic pulmonary resection. In this yet to be published article, completely portal is abbreviated as CPR and robotic assisted is abbreviated as RA. This nomenclature differentiates the different ways to perform robotic pulmonary resection. The important point is that the robot has now been used on almost a thousand patients to safely perform pulmonary resections and provides a minimally invasive surgical method.

A few of the advantages of the robot over VATS are obvious and they include: improved visualization, improved instrumentation that provide the surgeon more degrees of movement, better lymph node visualization and dissection, the ability to teach using a dual console, and the simulator. However, a few disadvantages include: limited platform availability as well as the capital and maintenance costs and expensive software incurred with the robot. An additional drawback is the fact that instruments have to be replaced after 10-20 uses based on whether they are 5 or 8 mm respectively. Finally, a complete portal approach does not allow the surgeon to palpate the lung whereas a robotic-assisted approach (such as VATS) allows the surgeon to feel the outer one-third of the lung.

Obviously, the enthusiasm for the robot has stemmed from its success in mediastinal resections and esophageal resections. Although this textbook is limited to pulmonary resections, we would be remiss and incomplete if we did not mention the success the robot has had in the mediastinum and esophagus for both malignant and benign esophageal lesions. This is a main reason why the thoracic surgeon has extended the use of the robot for pulmonary resection.

Future status of robotic pulmonary resection

The future of robotic surgery is exciting. There are several technical problems with robotic pulmonary resection. The primary limitation is the fact that the bedside assistant is placing the stapler on the pulmonary arteries and pulmonary veins. A robotic stapler that can be controlled by the surgeon is almost ready for release (planned release date is mid-June 2012).

Perhaps the most important instrument that will be released in the next year is a robotic vessel sealer, which is similar to the robotic harmonic scalpel but is a wristed instrument. This vessel sealer will allow the surgeon to go through the fissure, to seal and cut small pulmonary arteries and veins that are 7 mm or smaller and to seal the base of lymph nodes. Some surgeons are currently using the robotic

Harmonic scalpel for lymph node dissections during VATS or robotic surgery. However, the edges of this instrument are extremely hot and can damage surrounding tissue.

Another exciting instrument that has just made its way to the market in March 2012 is the robotic suction irrigator. It is a major advance that allows the surgeon to control both the suction and irrigation in the operative field. It can also be used for blunt dissection.

A promising area that the robot provides exclusively is the use of fluorescence of tissue. A special robotic camera can be placed into the operative field and allows the surgeon to view the tissue in a different color. Currently, indigotine (Indigo carmine) is the fluorescence agent of choice. It is given intravenously to the patient and by a specialized robotic camera the surgeon views vascularized tissue as green in the monitor and non-vascularized tissue as brown. Its current clinical usefulness is during partial nephrectomy by the urologist. However, we envision a more sophisticated use of the fluorescence of tissue. The ability to tag specific antigens such as Thymic ones, may allow the thoracic surgeon to be able to see the difference between thymus gland and the surrounding fat using the da Vinci monitor and the specialized camera. Fluorescence may also be able to help identify small pulmonary nodules that are embedded in the deep pulmonary parenchyma.

Other new techniques are being developed to help find small pulmonary nodules. These include placing magnetic coils or clips into or near small pulmonary nodules or by placing seeds or clips that emit a very low level of radiation. Specialized instruments are then hooked to the robotic arms that guide the surgeon to the nodule in question even though it cannot be seen or palpated.

There are many obstacles to adoption of the robot. The most important one is the lack of standardized credentialing. Some surgeons often try to perform pulmonary resections before the surgeons and/or their surgical teams have mastered easier robotic operations such as mediastinal tumor resection or lymph node biopsy. It is our belief there should be a standardized pathway or progression toward credentialing (1). This stepwise progression starts with inanimate object training, followed by on-line credentialing, followed by cadaver work, followed by the performance of level one surgical operation such as removal of small mediastinal tumors and lymph node biopsies. After 2 or 3 of these have been performed, level two operations should be performed next. These include wedge resection of the lung for interstitial lung disease and the enucleation of benign esophageal tumors. Once the team and the surgeon are comfortable with level I and II operations, the more complicated pulmonary lobectomy and pulmonary segmentectomy can be attempted. It is important to note that the credentialing may be required not only for the surgeon but rather the entire surgical team. Surgeon credentialing should apply to various surgical operations and not to all chest operations, i.e. a surgeon may be capable of safely performing a robotic wedge resection, but the surgeon may not be capable of safely performing a robotic lobectomy. All these issues need to be further addressed and resolved at a national level.

There have been several robotic surgeons who have misrepresented robotic surgery and had marginal results. Credentialing currently is not promulgated by a national board and is essentially in the hands of individual hospitals. This has led to misinterpretation, confusion, and some controversy. Clearly, a consensus statement from the STS, AATS, and ESTS is needed on credentialing for robotic surgery. Other impediments to adoption include the cost of buying a robot, the fee for maintenance of robot and its equipment and the limited platform availability to the thoracic surgeon.

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