LETTER TO THE EDITOR

Challenges and Opportunities in Thoracic Robotic Surgery

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ABSTRACT

Robotic surgery is a platform for minimally invasive thoracic surgery with similar general advantages as in VATS (Video Assisted Thoracic Surgery) including small incisions, faster recovery, minimal blood loss and shorter hospital stay. The extra advantages of using a robotic platform in thoracic surgery include a three-dimensional surgical view, elimination of physiological tremors, and enabling surgical manipulation in a natural orientation because of the presence of forceps that move in the same manner as human wrist joints. These advantages allow more complex procedures to be performed safely and easier technically, thus leading to better outcomes and improvement in the overall result. As a new advance in thoracic surgery, it has challenges that may become the reason why this technique has difficulty being adopted by a number of surgeons including cost, advancement in VATS technique and instrumentation. Despite the challenges, robotic thoracic surgery offers the platform for the expansion and improvement of thoracic surgery. Development in instrument technologies and designs, in addition to progress and interest in other futuristic technology, are notable opportunities for thoracic robotic surgery.

Keywords: Thoracic Surgery, Robotic Surgery
Introduction

Robotic surgery is a platform for minimally invasive thoracic surgery with similar general advantages as in VATS (Video Assisted Thoracic Surgery) including small incisions, faster recovery, minimal blood loss and shorter hospital stay. In addition to successfully many short-term and long-term benefits in safety and oncologic efficacy, minimally invasive thoracic surgery also demonstrates similar long-term survival rates in early-stage cancer and increased tolerance for adjuvant chemotherapy.

The extra advantages of using a robotic platform in thoracic surgery include a three-dimensional surgical view, elimination of physiological tremors, and enabling surgical manipulation in a natural orientation because of the presence of forceps that move in the same manner as human wrist joints. These advantages allow more complex procedures to be performed safely and easier technically, thus leading to better outcomes and improvement on the overall result such as pulmonary sleeve resection, mediastinal lymph nodes dissection, pulmonary resection in inflammatory and infective disease as well as large mediastinal tumor. Considering robotic platforms as a new advance in thoracic surgery, it has challenges that may become the reason why this technique has difficulty being adopted by a number of surgeons. However, oversight of this advanced technology as part of the surgical armamentarium would be a disadvantage to encourage the progression and development of thoracic surgery.

Challenges

The main challenge in starting the robotic surgery service in any centre would be the financial burden incurred in acquiring the technology itself. However, the cost of robotic surgery is not just the purchasing value but also includes the consumables items that come with each robotic procedure, in addition to capital and maintenance for robotic equipment such as sterilisation, storage, etc. This issue is more pressing, especially in the country where the surgery performed by the robotic platform is not covered by the insurance system. For instance, prostatectomy in Malaysia is the only robotic surgery procedure listed in the most insurance policy that allowed it to be reimbursed. Thus, the surgical cost of robotic surgery other than being mentioned has to be covered by the patients themselves. The successful centres providing robotic surgery services usually have good funding systems and dedicated teams that are able to do a sufficient number of cases thus reducing the overall cost and improving overall outcome.

In the limitation of easy access to a robotic surgical system, new devices have been developed to offer a valid alternative for VATS instruments that mimic robotic arms. Articulated instruments such as ArtiSental, Intuitool, Flexdex and Radius Surgical System offer additional options for surgeons. These wristed instruments differ from conventional laparoscopic instruments owing to a wrist-like mechanism at the tip, which reproduces the movements of the surgeon’s hands, regaining more movement degrees. These instruments offer much cheaper versions similar to robotic arms and are able to be used in paediatric patients.

Opportunities

Using the robotic platform in thoracic surgery is a step further in advanced surgical technique. It is well-proven and had been demonstrated well by literature. Performing surgery with a robotic platform has a number of advantages including excellent 3D visualisation, physiological tremor elimination, and dexterity that more superior in accuracy to perform some surgeries that are not feasible with the manual thoracoscopic technique currently available.
Having the robotic procedure in place, allows the development and progress in respective surgery to be more advanced and accelerated, associated with improvement in intraoperative and postoperative results, thus better overall outcomes for the patients.\textsuperscript{11}

The development of smaller thoracoscopes, high-definition charge-coupled device cameras, 3D vision systems and variable wide viewing angle endoscopes have further refined minimally invasive thoracic surgery, making it safer, more easily adoptable and less invasive.\textsuperscript{26} These ongoing developments are the plus points for surgical robotic technology to improve and further advance. In addition to progress and interest in other technologies eg Artificial intelligence\textsuperscript{27} Virtual Reality\textsuperscript{28}, nanorobot technology\textsuperscript{29, 30}, and augmented reality\textsuperscript{31}, it is not impossible for those technologies to merge and combine with robotics surgery platforms and perform thoracic surgery in the future.

**Conclusion**

The evolution of thoracic surgery over the decades has demonstrated that more treatment options and surgical approaches could be offered for the needed patients and related stakeholders. The future of the robotic surgery platform in thoracic surgery predictably will be successful in the region with adequate resources and support, however rather uncertain to progress in the region with limited interest and basic foundation in the respective technology.
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