

Initial Consecutive Experience of Completely Portal Robotic Pulmonary Resection with 4 Arms

Cerfolio RJ, Bryant AS, Skylizard L, Minnich DJ. J Thorac Cardiovasc Surg. 2011 Oct;142(4):740-6. Epub 2011 Aug 15.

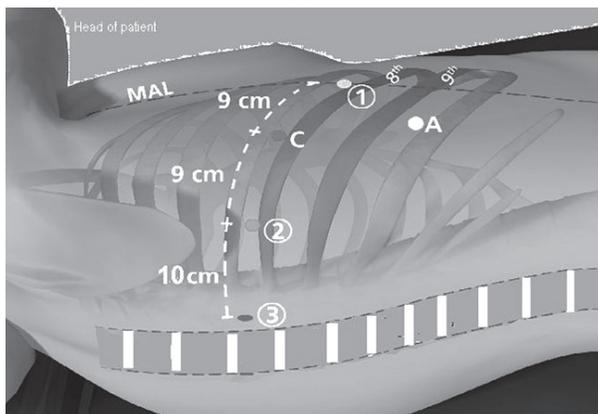
This paper describes an experience of “Completely Portal Robotic Pulmonary Resection with 4 Arms (CPRL-4)”, which was performed using robotic-assisted surgery.

Robotic-assisted pulmonary resection is rapidly growing because of improvements in 3D visualization, the technical advantages of wristed instrumentation, and the ability to perform an outstanding lymph node dissection.

This study reports an experience with robotic-assisted pulmonary resection with carbon dioxide insufflation, and compares the short-term outcomes with those patients undergoing resection through a rib- and nerve-sparing thoracotomy.

In 14 months, 148 patients underwent robotic-assisted pulmonary resection (106 lobectomies, 26 wedge resections, 16 segmentectomies). All patients underwent R0 resection and removal of all visible lymph nodes (median of 5 N2, 3N1 nodal stations, 17 lymph nodes). The 106 patients who underwent robotic-assisted lobectomy were compared with 318 propensity-matched patients who underwent lobectomy by rib- and nerve-sparing thoracotomy.

The 4-arm port-based approach



Note: See Appendix 1 of publication for an in-depth operative description.

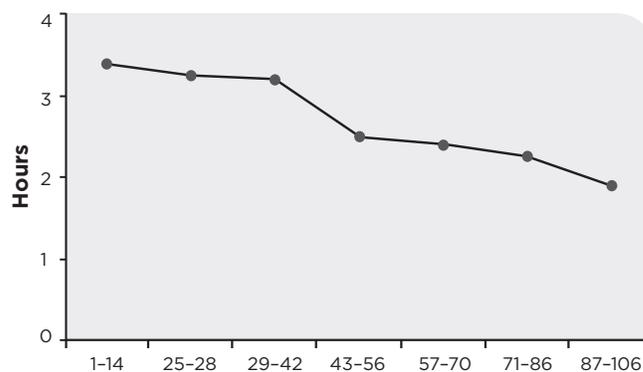
Key Takeaways

- There was no statistically significant difference in the total number of lymph nodes removed or in the median number of N2 or N1 lymph nodes assessed
- The robotics group had significantly less blood loss, shorter chest tube duration, shorter hospital stay, and less postoperative pain compared to the thoracotomy group
- The robotics group had lower incidence of morbidity and no operative mortality
- The robotics group had improved mental quality of life
- Results of robotic-assisted lobectomy (CPRL-4) show a trend toward reduction in median operative time from over 3.7 hours to under 1.9 hours skin to skin

Study Limitations

- Study enrolled many patients who might not have been offered VATS lobectomy at most institutions. Most VATS studies select patients with small T1 or T2 NO MO (<3 cm) lesions. Note that this is not a selected series, but rather a consecutive series of patients who had clinically diagnosed resectable non-small cell lung cancer (NSCLC). Therefore, patients who underwent VATS lobectomy were not chosen as a comparison group, because it was only offered to selected patients.
- One surgeon performed all the open and robotic-assisted operations, and it was a consecutive series as opposed to highly selected patients.

Median operative times (skin to skin closure) for completed completely robotic-assisted lobectomy with time in sequential order



CPRL-4 operation (in sequential order)

Artist representation modeled after original publication. Data points are approximated.

Data

Outcomes

| | Robotic-Assisted (CPRL-4) operation (n=106) | Rib- and nerve-sparing thoracotomy (n=318) | p value |
|--|---|--|---------|
| Estimated blood loss (mL, median ± SD) | 30 ± 26 | 90 ± 22 | .03 |
| Operative time (h, median, ± SD) | 2.2 ± 1.0 | 1.5 ± 0.8 | <.001 |
| No. of mediastinal (N2) lymph node stations removed (median) | 5 | 5 | >.999 |
| No. of mediastinal (N2) lymph nodes removed (median) | 12 | 11 | .906 |
| No. of N1 lymph node stations removed (median) | 3 | 3 | >.999 |
| No. of N1 lymph nodes removed (median) | 5 | 4 | .89 |
| Chest tube duration (d, median and range) | 1.5 (1-6) | 3.0 (1-67) | <.001 |
| Hospital stay (d, median and range) | 2.0 (1-7) | 4.0 (1-67) | .01 |
| Morbidity (no.,%) | 28 (27) | 120 (38) | .05 |
| Operative mortality (no.,%) | 0 | 11 (3) | .11 |
| Verbal pain score 3 wk postoperatively (median and range) | 2.5 (0-7) | 4.4 (0-8) | .04 |

Conclusion

Minimally invasive, non-rib spreading approach for lung cancer patients (robotic-assisted or VATS) needs to uphold all of the oncologic benefits of open surgery (thoracotomy). The authors believe this to be the case with robotic-assisted (CPRL-4) lobectomy when compared to open thoracotomy.

This study demonstrates the safety, efficacy, and the ability to achieve an R0 resection with complete lymph node removal with robotic-assisted lobectomy. Moreover, data shows that robotic-assisted lobectomy has lower morbidity, shorter hospital stay, and better quality of life than rib- and nerve-sparing thoracotomy.

Financial Disclosure

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Thoracic Surgery Risks

Pulmonary Resection (Wedge Resection, Segmentectomy, Lobectomy): persistent air leak, pneumonia, prolonged mechanical ventilation >48 hours, atrial fibrillation, acute respiratory distress syndrome (ARDS), chylothorax, re-intubation, arrhythmias, bronchopleural fistula, phrenic nerve injury, esophageal injury, difficulty breathing, collapsed lung, pulmonary volvulus, recurrent laryngeal nerve injury leading to vocal cord dysfunction.

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The demonstration of safety and effectiveness for the specific procedure(s) discussed in this material was based on evaluation of the device as a surgical tool and did not include evaluation of outcomes related to the treatment of cancer (overall survival, disease-free survival, local recurrence) or treatment of the patient's underlying disease/condition. Device usage in all surgical procedures should be guided by the clinical judgment of an adequately trained surgeon.

The friable nature of pulmonary tissue enhances the risk of vascular, bronchiolar or other injury that will be difficult to control when using this device. Published clinical experience as well as clinical studies performed to support this marketing clearance have demonstrated that even surgeons considered expert in laparoscopy/thoracoscopy have substantial learning curves of 10 to 12 cases (Falk, et al., Total endoscopic computer enhanced coronary artery bypass grafting, *Eur J Cardiothorac Surg* 2000; 17: 38-45).

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