Robotic-Assisted, Video-Assisted Thoracoscopic and Open Lobectomy: Propensity-Matched Analysis of Recent Premier Data

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This study's objective was to provide a comparative analysis of perioperative clinical outcomes from elective robotic-assisted lobectomy (RL), VATS lobectomy (VL), and open lobectomy (OL).

The Premier Healthcare Database was analyzed for lobectomies performed from January 1, 2011 to September 30, 2015. International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) diagnosis and procedure codes were used to identify surgical approaches (RL, VL, and OL), complications, and conversions to OL.

Propensity score matching (1:1) for patient and hospital characteristics allowed comparison of RL versus OL (n = 2,775 each) and RL versus VL (n = 2,951 each). The following covariates were used for matching: patient characteristics—age, sex, race, Elixhauser comorbidity score, and type of malignancy; and hospital characteristics—payor type, census region, hospital size (number of beds), type of hospital facility (academic or community), and location of the facility (urban or rural).

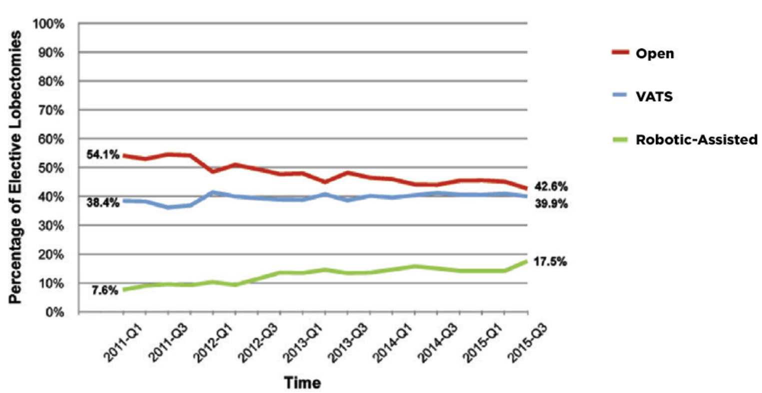
Patient populations were statistically similar after matching. Most patients were age 45 to 80 years (mean 67 years) and had lobectomy for primary neoplasm of the lung. Sex distribution and Elixhauser comorbidity scores also were similar between cohorts. Medicare was the predominant payor, and the most prevalent hospital settings were large, urban teaching institutions.

Analyzed data included perioperative outcomes (operating room time, conversion to open, blood transfusion, length of hospital stay, discharge status, complications, and mortality). Complications were assessed as intraoperative, postoperative (surgery through discharge), index hospitalization (admission to discharge), and 30 days (admission to 30 days).

Data

Adoption of robotic-assisted lobectomy (green line), video-assisted thoracic lobectomy (blue line), and open lobectomy (red line) as percentages of all elective pulmonary lobectomies from January 1, 2011 to September 30, 2015.

(**Q** = quarter; **VATS** = video-assisted thoracoscopic surgery.)



Key takeaways

- Propensity matched analysis shows that RL is associated with a generally lower postoperative complication rate and improved recovery endpoints compared with both OL and VL.
- There continues to be an increase in the number of RL procedures performed. Together, RL and VL now account for more than half of all lobectomies in this US database, indicating a strong trend to more minimally invasive lobectomies.
- The Premier database captures a more heterogeneous, unselected, real-world population with approximately one-third of the patients operated on in community hospitals after propensity matching. In contrast, The Society of Thoracic Surgeons database predominantly favors high-volume academic or teaching institutions.

Study limitations

- Oncologic data, such as size of the tumor, stage, recurrence, and survival, could not be extracted from the Premier Healthcare Database. There is a possibility of selection bias; patients who underwent OL may have had larger or more central tumors or bulky mediastinal and hilar lymphadenopathy that led to the selection of OL. However, tumor size should presumably not affect the choice between the two minimally invasive approaches.
- As anticipated in any large administrative database, there is potential for coding errors in the data.

Data

Summary of Clinical Outcomes and Complications, Matched Analysis (1:1)

Outcome	RL (n = 2,775)	OL (n = 2,775)	*p* Value (RL vs. OL)	RL (n = 2,951)	VL (n = 2,951)	*p* Value (RL vs. VL)
OR time, minutes	275.5 ± 94.6	235.3 ± 93.5	<0.0001	275.1 ± 93.9	247.6 ± 86.8	<0.0001
Complications						
Postoperative[a]	961 (34.6)	1,198 (43.2)	<0.0001	1,007 (34.1)	1,109 (37.6)	0.0061
Thirty-day	1,048 (37.8)	1,272 (45.8)	<0.0001	1,101 (37.3)	1,195 (40.5)	0.0130
Index hospital LOS, days	7.0 ± 5.7	8.9 ± 5.9	<0.0001	6.9 ± 5.5	7.3 ± 7.5	0.0060
Median, days	5	7		5	6	
Discharge status						
Health facility	188 (6.8)	284 (10.2)	<0.0001	190 (6.4)	234 (7.9)	0.0302
Home	2,559 (92.2)	2,442 (88.0)	<0.0001	2,734 (92.7)	2,679 (90.9)	0.0108
Conversion to open	179 (6.5)	NA		187 (6.3)	387 (13.1)	<0.0001
Mortality[b]						
Index hospital	28 (1.0)	48 (1.7)	0.0282	27 (0.9)	34 (1.2)	0.4400
Thirty-day	36 (1.3)	62 (2.2)	0.0108	35 (1.2)	40 (1.4)	0.6420
Postoperative bleeding[c]	128 (4.6)	290 (10.5)	<0.0001	130 (4.4)	275 (9.3)	<0.0001
Postoperative transfusion[c]	104 (3.8)	151 (5.4)	0.0032	102 (3.5)	109 (3.7)	0.6740

[a] Postoperative complications included all complications occurring after surgery through discharge.
[b] Mortality rate was measured from admission to discharge ("Index hospital") and admission to 30 days ("30-day").
[c] Postoperative bleeding and transfusions that occurred through discharge were included.

Values are mean ± SD or n (%).

LOS: length of stay; **NA**: not applicable; **OL**: open lobectomy; **OR**: operating room

RL: robotic-assisted lobectomy; **VATS**: video-assisted thoracic surgery; **VL**: VATS lobectomy

Results

- During the study period, the number of lobectomies performed by OL had an absolute decline of 11.5%, while the numbers of RL and VL cases saw an absolute increase of 10% and 1.5%, respectively.
- RL had lower complication rates both postoperatively and at 30 days when compared to VL and OL.*
- RL was associated with a reduced LOS when compared to VL and OL.
- Patients in the RL group were more likely to be discharged home than to a transitional health care facility, when compared to VL and OL.
- RL had fewer conversions when compared to VL.
- RL had a lower in-hospital and 30-day mortality rate when compared to OL.

*In comparison with OL, additional reviewed clinical studies report a lower or comparable postoperative complication rate, shorter LOS, and comparable in-hospital mortality.[1-8] In comparision with VL, additional reviewed clinical studies report a comparable, lower, or higher postoperative complication rate,[1-4,9-19] comparable or shorter LOS[1-4, 8-19] and comparable conversion rate.[8-16]

PUBLICATION SUMMARY

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The friable nature of pulmonary tissue enhances the risk of vascular, bronchiolar or other injury that will be difficult to control when using thisdevice. 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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