Department of Surgery

Robotic Sublobar Resection for the Surgical Management of Isolated Pulmonary Nodules

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Background

- Techniques for anatomic pulmonary resection:
  - Rib-sparing thoracotomy- current standard of care
  - Video-assisted thoracoscopic surgery- similar perioperative and oncologic efficacy
  - Robotic-Assisted Lung resection- newer minimally invasive option
- Theoretical advantages of robotic lung surgery: 7 degrees of freedom, 3-D Hi-Definition camera, dampens tremor, no fulcrum effect, operating surgeon may use three arms simultaneously, seated position more comfortable for operating surgeon
- Few studies to date evaluate robotic-assisted segmentectomy for lung lesions. We present our initial experience with robotic assisted segmentectomy at LVHN with previously established data on the topic.

Methods

- Retrospective review of all robotic segmentectomies performed at LVHN
- October 2011 through June 2014: 186 robotic pulmonary resections performed.
- Total of 36 robotic anatomic segmentectomies
- Perioperative outcomes evaluated: Length of stay, operating room time, conversion rate, estimated blood loss, 30-day mortality, hospital based complications, number of lymph nodes, tumor size, surgical margin, FEV1, recurrence. Conversions were excluded in analysis.
- All cases were performed by a single surgeon (M.F.S) with the use of the Da Vinci robotic system.

TABLE 1.										
Lead Author	Year	N	V/R/O	LOS (days)	Operative time (min)	Operative blood loss (mL)	30 Day Mortality	Complication Rate (%)	Mean Follow-up (months)	Lymph Nodes Harvested (stations)
Szwerc et al	2014	34	R	2.6	132	52	0	23.53	9	4.9 (3.3)
Pardolesi et al	2014	17	R	5	189	NS	0	17.6	NS	NS
Gossot et al	2013	117	V	5.5	181	77	NS	11.7	NS	21 (3.5)
Qian et al	2013	35	V	6.2	125	162.5	2.86	8.3	10.9	NS
Leshnower et al	2010	15	V	3.5	145	NS	0	0	NS	4 (3)
Leshnower et al	2010	26	V	8.3	140	NS	8	35	NS	6 (3)
Witte et al	2010	20	V	8.5	212	NS	0	25	NS	NS (4.5)
Watanabe et al	2009	41	V	NS	220	183	NS	9.7	70	25 (8)
Schuchert et al	2009	104	V	6.4	136	171	0	26.0	16.2	6.4
Schuchert et al	2009	121	0	8.2	143	220	1.65	33.9	28.2	9.1
Oizumi et al	2009	29	V	NS	216	100	0	6.9	NS	NS
Atkins et al	2007	48	V	4.3	136	250	0	31.3	NS	NS (4.1)
Atkins et al	2007	29	0	6.8	130	280	6.9	34.5	NS	NS (3.9)
Shiraishi et al	2004	34	V	12.7	240	169	0	11.8	21.9	NS
N=number of patients, V=VATS, TT=totally thoracoscopic, R=robotic-assisted, 0=open, numbers presented as means, NS=not stated										

Table 1. This table presents some results alongside of previously published data. Compared to the other published date, our results have the lowest intraoperative estimated blood loss as well as post-operative length of stay.

Results

- Conversion rate 5.5% (2/36); excluded from further analysis
  - Mean age: 65.4(41-83)
  - Mean EBL: 51.9mL (20-150)
  - Mean tumor size was 1.57cm (0.7-3)
  - Mean lymph nodes removed: 4.85 (0-10)
  - Median Length of stay: 2 days
  - Complication rate: 23.53%
  - Mean BMI: 27.9(17.9-42.3)
  - Mean OR time: 121 minutes (49-315)
  - Positive margins: 0/34
  - Mean Lymph node stations: 3.32 (0-7)
  - Readmission rate was 11.76% (n= 4/34)

Figure 1.
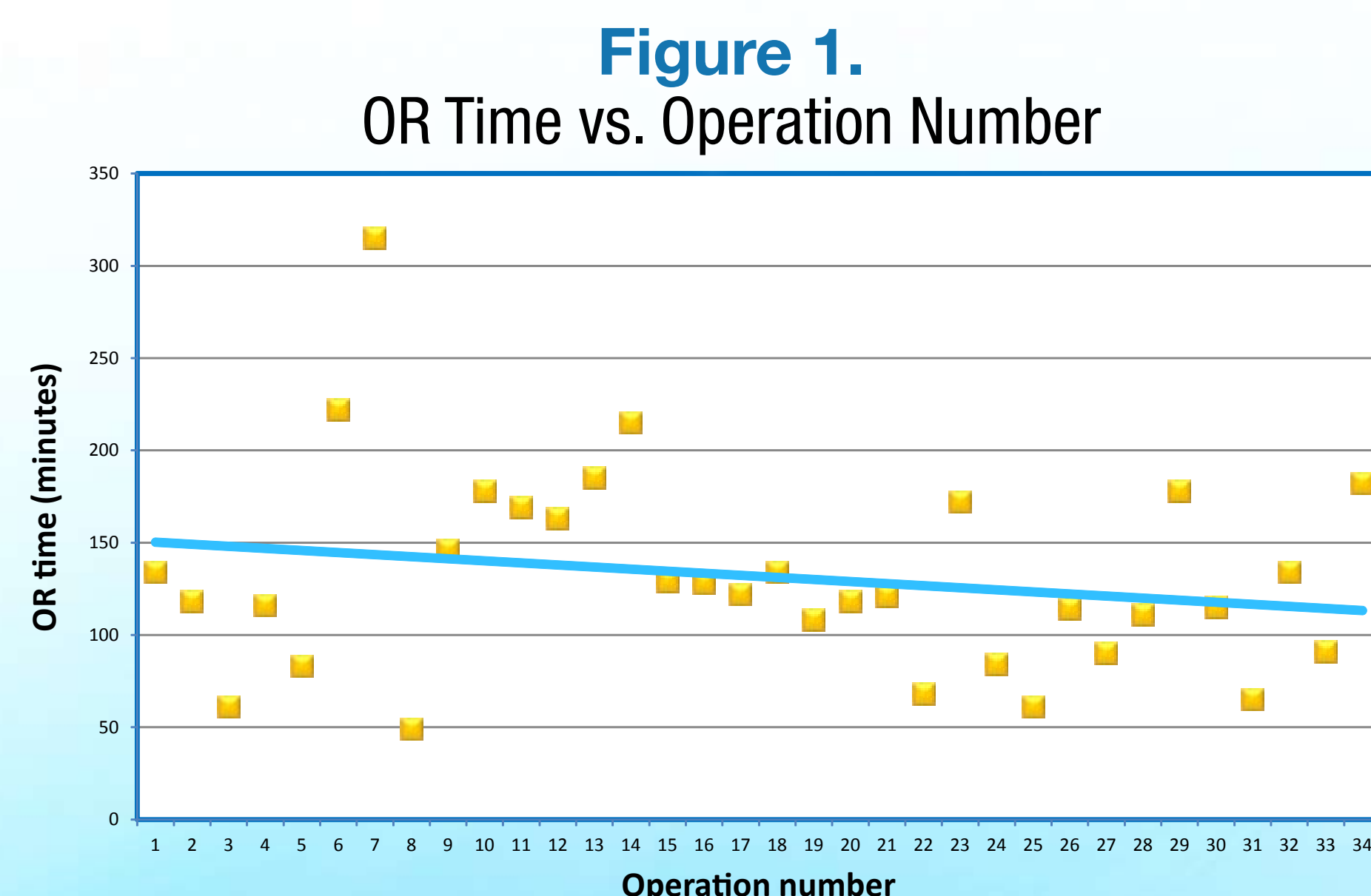OR Time vs. Operation Number

Figure 1. This graph depicts the operation time in minutes versus the operation number in consecutive order. The best fit line depicts a decrease in operating time as the number of operations increases.

Discussion

- Only about 20-30% of all anatomic lung resections are performed using VATS.
- Technical difficulty of VATS may be a barrier to minimally invasive chest surgery, which robotic surgery may overcome.
- Current literature suggests that robotic surgery may offer similar results as VATS but with a faster learning curve.
- Longer follow-up period is needed to assess long term oncologic efficacy. Cost analysis should be performed to evaluate if the higher price of the robotic systems outweigh the possibly decreased OR time and hospital stay.

Using the robotic Da Vinci robotic platform during thoracic surgery.

Conclusion

- The study demonstrates the feasibility, safety, and efficacy of robotic-assisted pulmonary segmentectomy for the treatment of isolated lung tumors.
- Robotic-assisted segmentectomy appears to offer shorter length of stay, EBL, and OR time than video-assisted or open techniques [3-11]. Further studies would be needed to compare robotic segmentectomies to VATS procedures.
- Robotic-assisted segmentectomy an may be a beneficial procedure in the treatment of early stage lung tumors, as it can be performed with acceptable mortality, morbidity, recurrence, and length of stay.

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