

Pulmonary Function Improvement after Lung Volume Reduction Surgery: A Twenty-year Experience

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Disclosures

Reddy, RM-Intuitive Surgical, Auris Health,
Medtronic, Genentech, On Target Labs

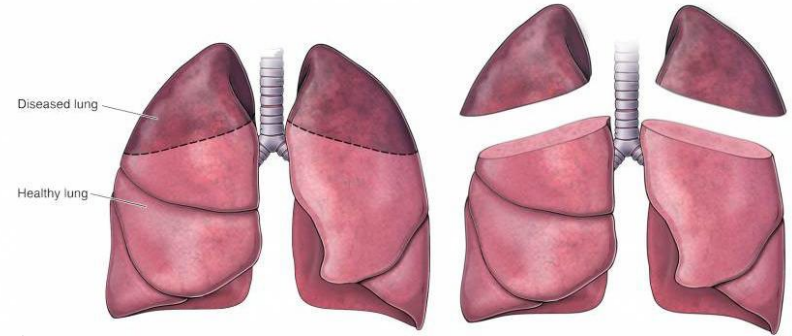
Lin, J-Intuitive Surgical

Non relevant to this talk



National Emphysema Treatment Trial (NETT) Findings

- NETT distinguished favorable versus unfavorable characteristics of candidates for LVRS
 - Recommended for upper-lobe-predominant (Fishman, et al. 2003)
- LVRS, supplemental oxygen and smoking cessation improve survival in selected patients (Criner, et al. 2011)
- LVRS remains an underused therapy



Objective

To evaluate post-operative outcomes of lung volume reduction surgery (LVRS) at a high-volume institution that participated in the National Emphysema Treatment Trial (NETT) and continues to follow NETT criteria.

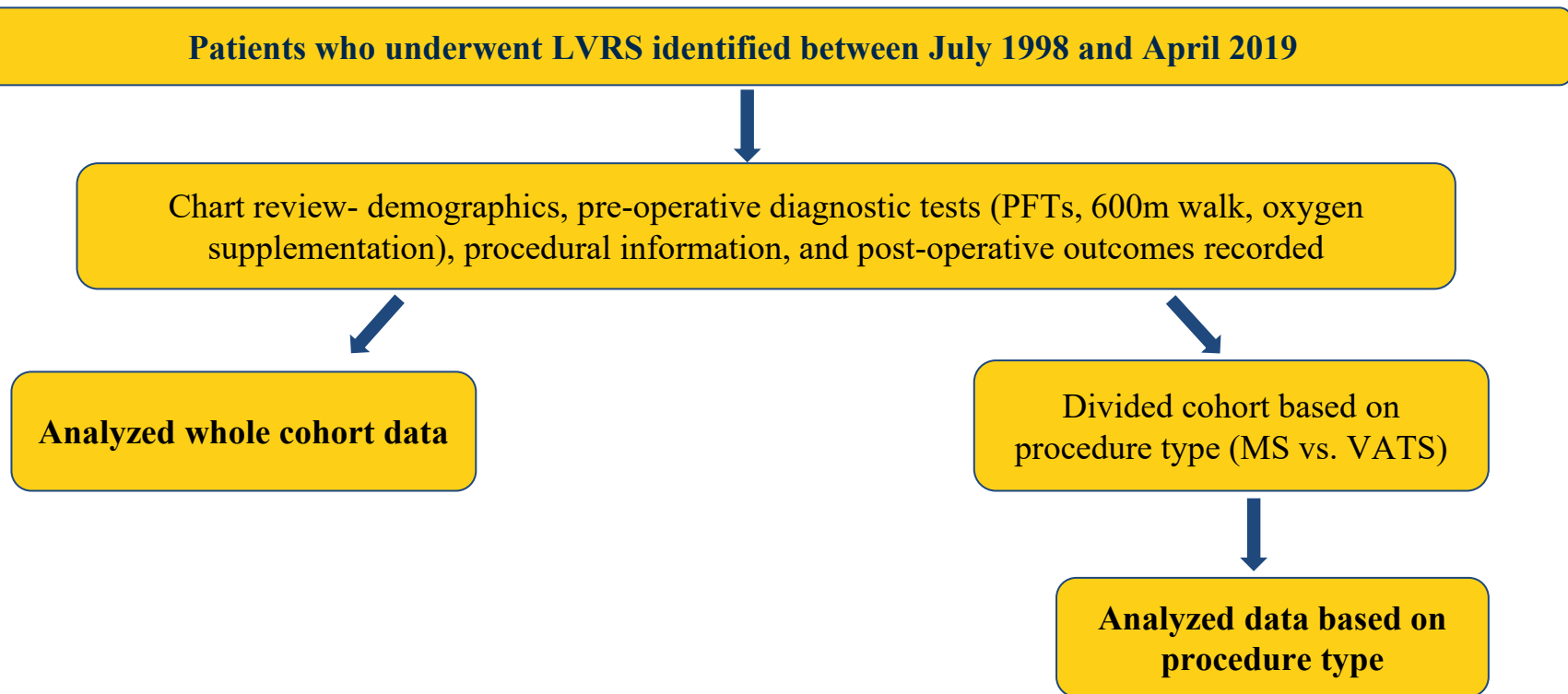
Criteria for LVRS

Criteria for LVRS
<i>Inclusion</i>
History and physical examination consistent with emphysema
CT Scan evidence of bilateral upper-lobe-dominant emphysema
Pre-rehabilitation post-bronchodilator $TLC \geq 100\%$ and $RV \geq 150\%$
$FEV1 \leq 45\%$
$PaCO_2 \leq 60\text{mmHg}$
$PaO_2 \geq 45\text{mmHg}$
Cotinine $\leq 13.7\text{ng/ml}$
$BMI \leq 31.1$ (males) or ≤ 32.3 (females)
Quit smoking at least 4 months before surgery
Completion of pre-rehabilitation assessments
Completion of NETT rehabilitation program
<i>Exclusion</i>
Daily use of prednisone $> 20\text{mg}$
No other major disease
Previous heart or lung surgery

Criteria for study based on
NETT



Methods



Cohort Demographics

Average age
was 62 ± 7.6
years

Total of 151
patients

Average
smoking
history of
 54 ± 24.3 pack
year

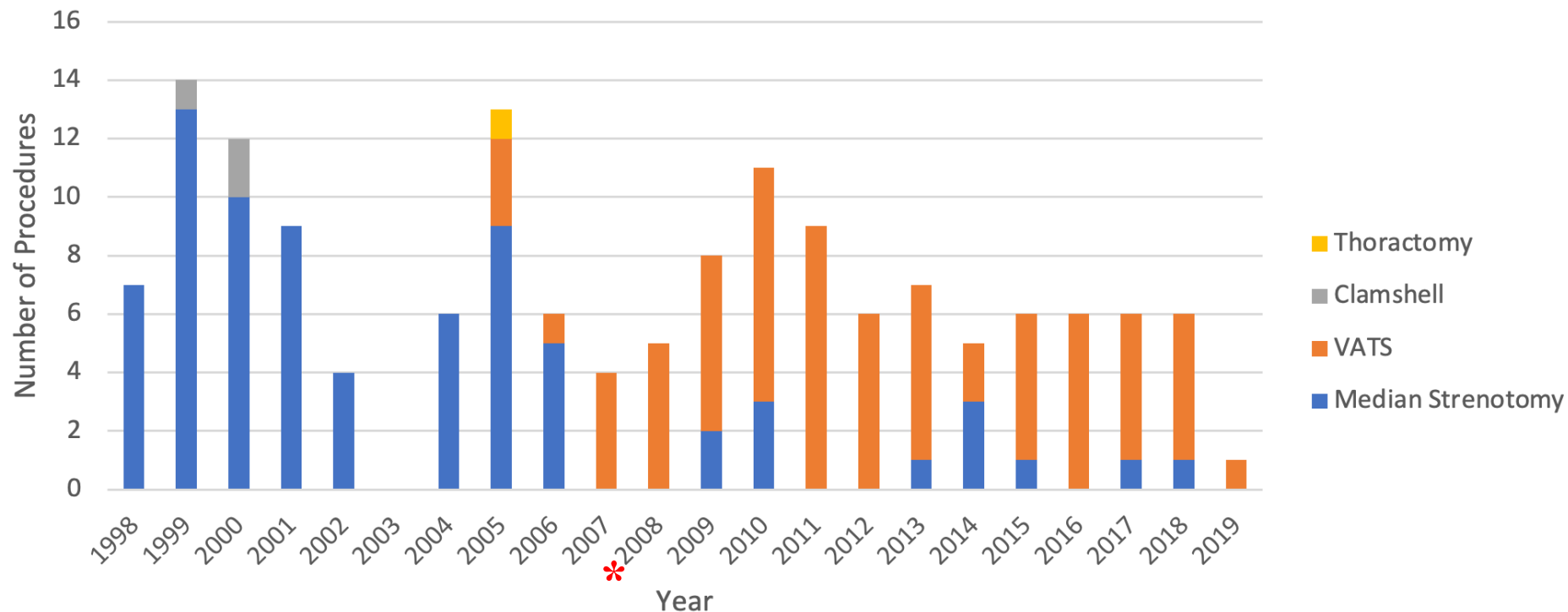


Cohort Pre-operative Pulmonary Function Tests

<i>Pre-Op Pulmonary Function Tests</i>	Cohort
FVC (L) (<i>n</i> =150)	2.4±0.76
FEV1 (L) (<i>n</i> =150)	0.72±0.2
FEV1 % of Predicted Value (<i>n</i> =150)	27.4±6.9
FEV1:FVC % (<i>n</i> =150)	30.9±5.98
Carbon Monoxide Diffusing Capacity (mL/min/mmHg) (<i>n</i> =122)	8.97±4.2
Carbon Monoxide Diffusing Capacity % of Predicted Value (<i>n</i> =122)	35.6±13.4
Total Lung Capacity (L) (<i>n</i> =140)	8.5±10.7

All subjects met NETT criteria for pre-operative PFTs

Procedure Type



MS vs. VATS

Characteristics	Median Sternotomy (n=75)	VATS (n=72)
Age at Surgery (yr)*	63±7	60.6±7.9
Sex- no. (%)		
Female	31 (41)	38 (53)
Male	44 (59)	34(47)
Body Mass Index	25.4±4.14	25.9±4.03
Smoking History (Pack-years) *	59.5±26.4	49.2±21.6
No. of years quit before surgery	7.26±6.63	6.1±6.54
Pre-Op Supplemental Oxygen (L)	1.8±1.5	2.4±1.5
Pre-Op Exercise Capacity (watt)	37.5±16.8	35.7±19.6
Distance walked in 6 min (ft).	886±468.5	813.1±437.9
PaO2- mmHg*	65.8±13.2	78.9±20.4
PaCO2- mmHg	41.7±4.04	42.9±5.38
Pre-Op Pulmonary Function Tests		
FVC (L)	2.47±0.76	2.31±0.75
FEV1 (L)	0.72±0.2	0.72±0.2
FEV1 % of Predicted Value	27.7±7.45	27.9±6.43
Carbon Monoxide Diffusing Capacity (mL/min/mmHg)	9.1±3.4	8.9±4.7
Carbon Monoxide Diffusing Capacity % of Predicted Value	35.3±9.7	35.8±15.6
Total Lung Capacity (L)	7.99±4.2	9.2±15.4

VATS group was younger (p=0.045) and presented with fewer smoking pack-years (p=0.013)



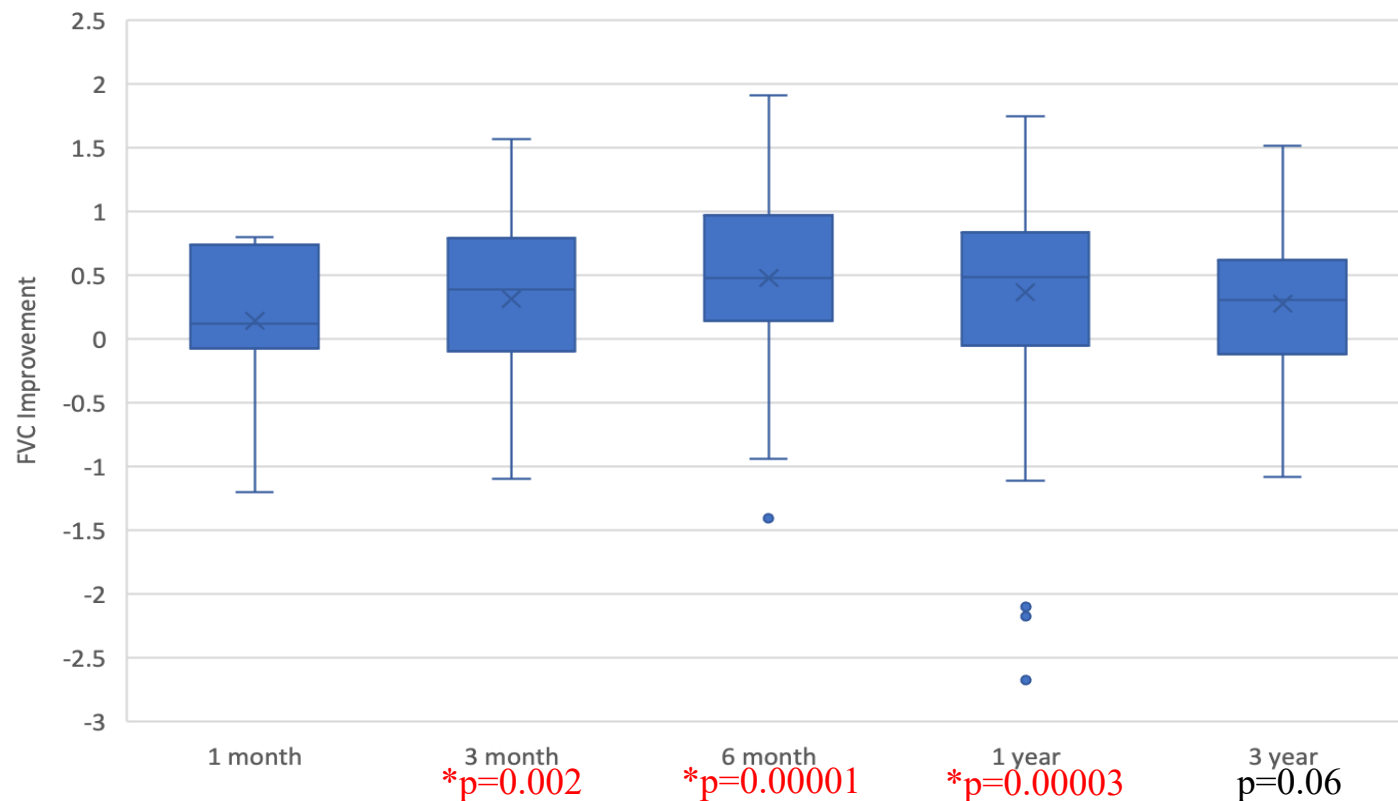
Perioperative Outcomes

	Median Sternotomy (n=75)	VATS (n=72)
Complications	No. (%)	No. (%)
New CT placed	6 (8)	7 (10)
Respiratory distress	13 (17)	22 (31)
Respiratory failure	7 (9)	10 (14)
Pneumonia	20 (27)	14 (19)
Reintubation	10 (13)	10 (13)
Tracheostomy	2 (3)	1 (1)
<u>Afib SVT</u>	16 (21)	25 (35)
PE	0 (0)	1 (1)
MI	0 (0)	2 (3)
AKI	8 (11)	3 (4)
Wound Infection	3 (4)	1 (1)
Re-op	8 (11)	5 (7)
Re-admit to ICU	8 (11)	10 (14)
Hospital Mortality	9 (12)	5 (7)
SQ emphysema* ($p=0.03$)	6 (8)	15 (21)
Initial Air leak* ($p=0.03$)	45 (60)	55 (76)
Prolong air leak	37 (49)	45 (63)
	Mean \pm STD	Mean \pm STD
Hospital LOS	11.37 \pm 9.56	11.97 \pm 10.68
ICU LOS	3.02 \pm 6.54	4.52 \pm 8.24
Chest tube days	15.63 \pm 18.3	15.52 \pm 17.29
Ventilator time	0.027 \pm 0.23	1.04 \pm 4.75
Reintubation Days	2.44 \pm 3.84	6.58 \pm 8.5
EBL (cc)* ($p=0.03$)	133 \pm 145.2	88.4 \pm 130.3
Surgery Duration(min)	192.28 \pm 44.7	232.3 \pm 155.6

- Decrease in EBL over time*
- VATS associated with increased risk of initial air leaks and subcutaneous emphysema
- No other significant differences between MS and VATS

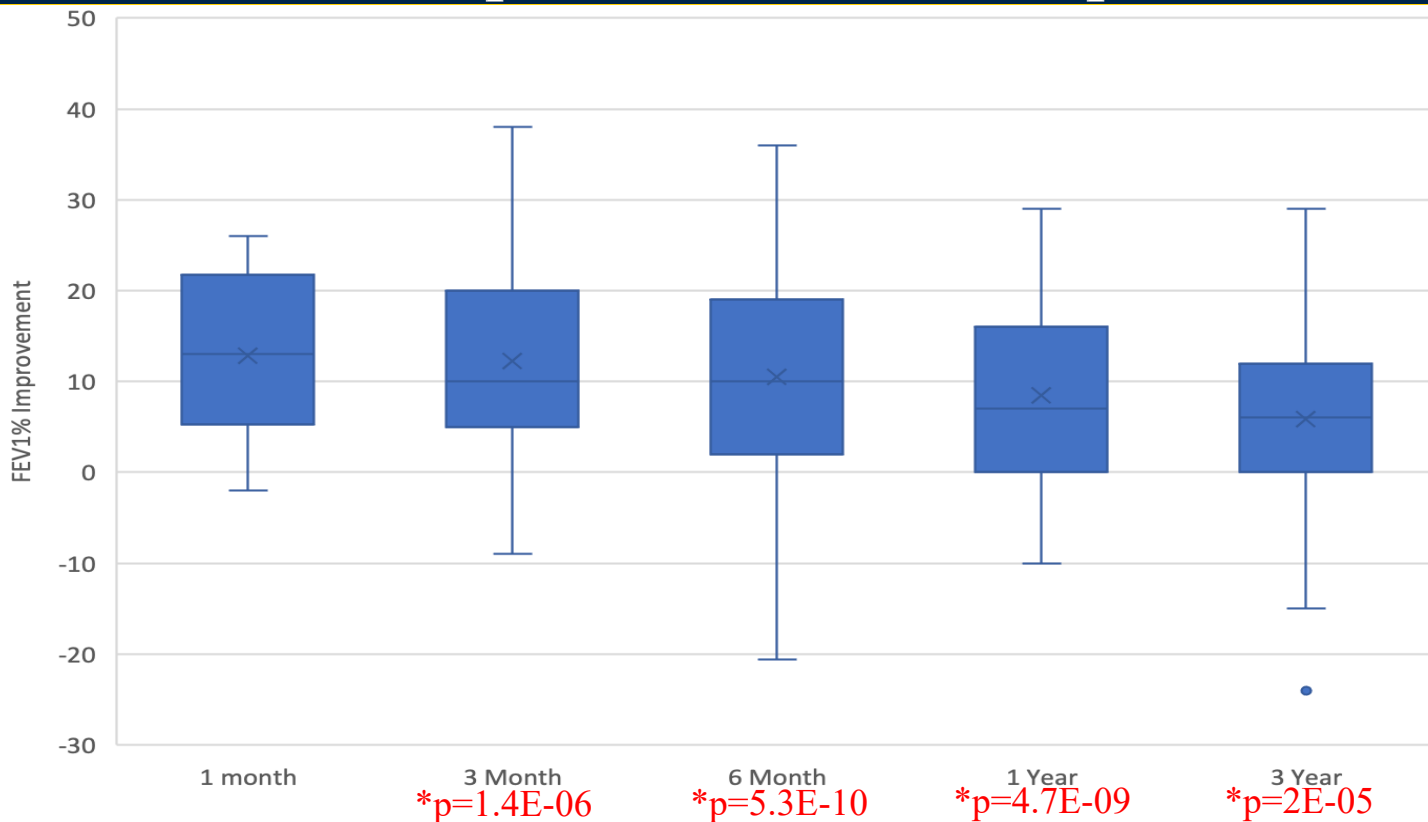


Cohort Post-operative FVC Improvement



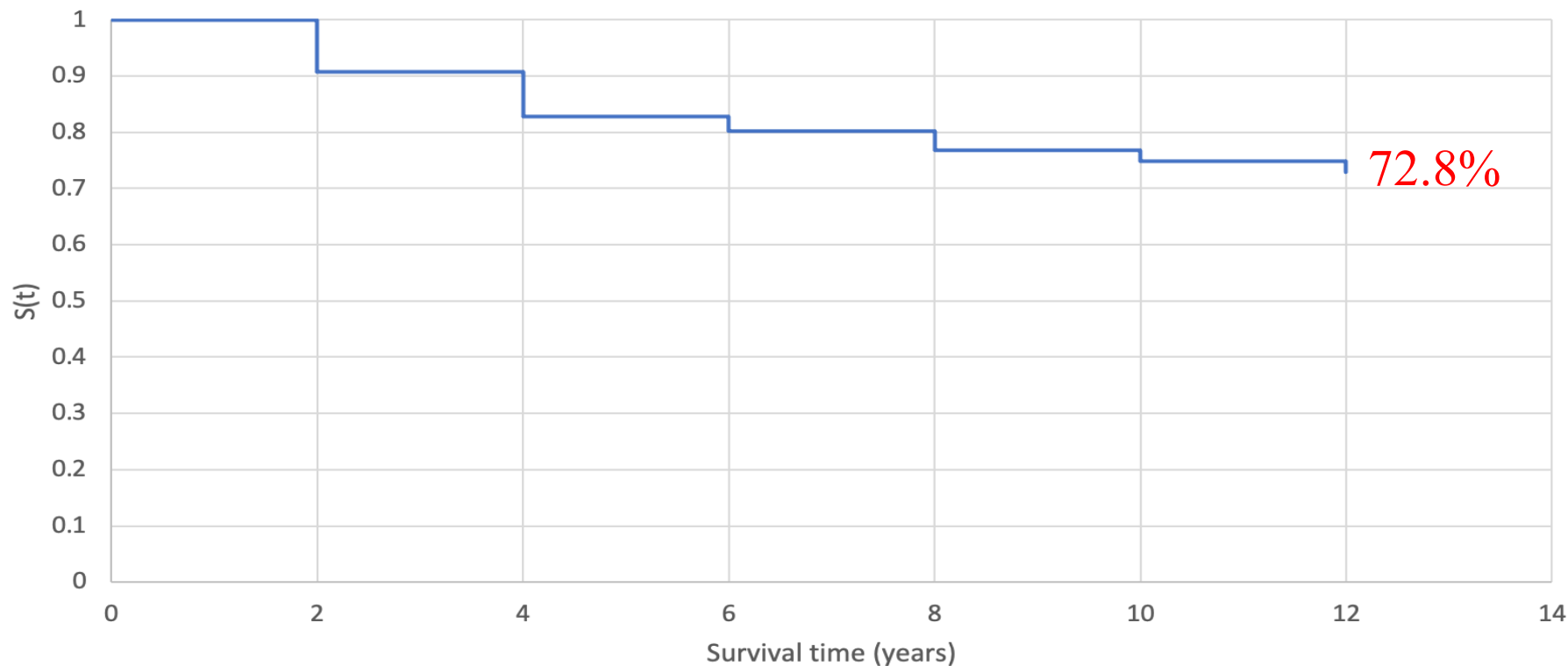
PFTs taken at 3 months, 6 months and 1 year showed significant improvement in FVC compared to pre-operation

Cohort Post-operative FEV1% Improvement

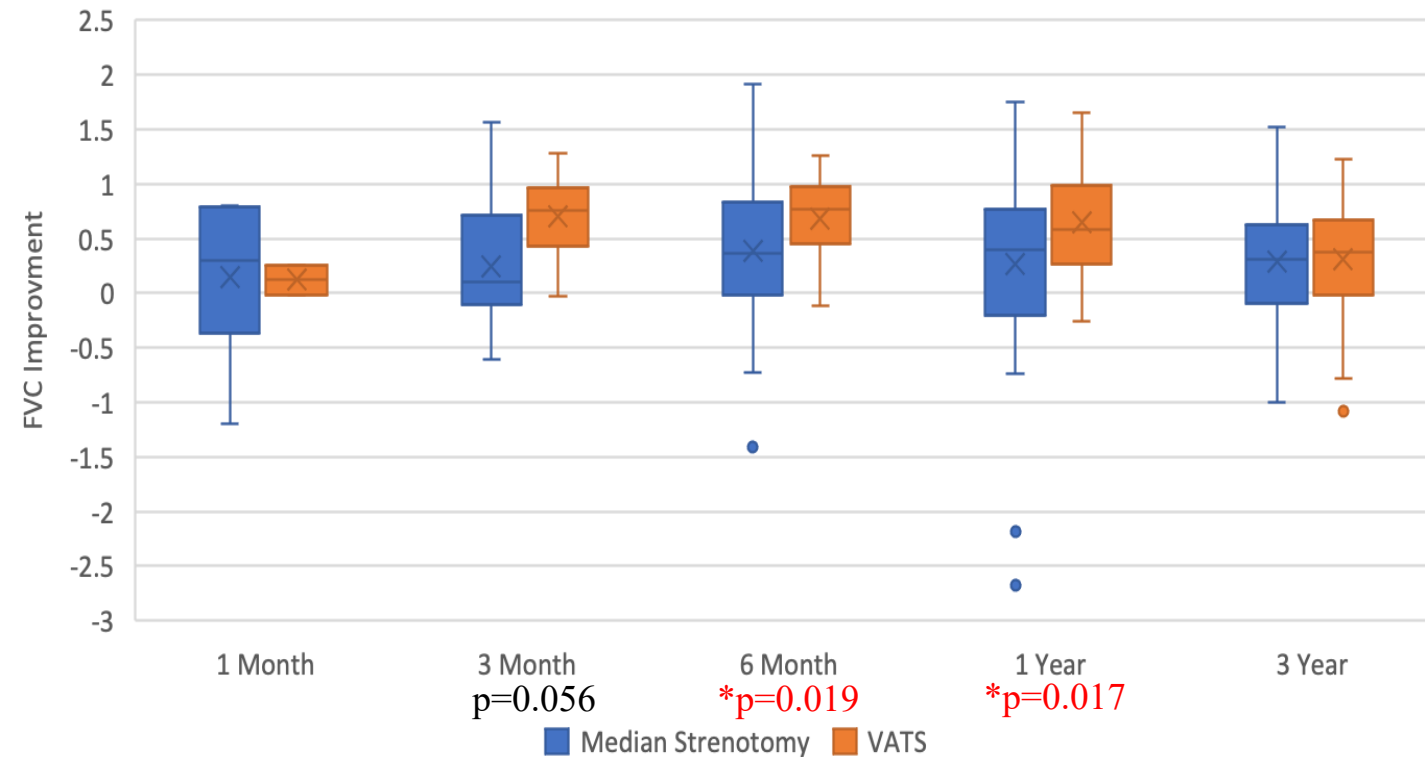


Significant improvement in FEV1% seen at 3 months, 6 months, 1 year, and 3 years

Cohort Survival Curve



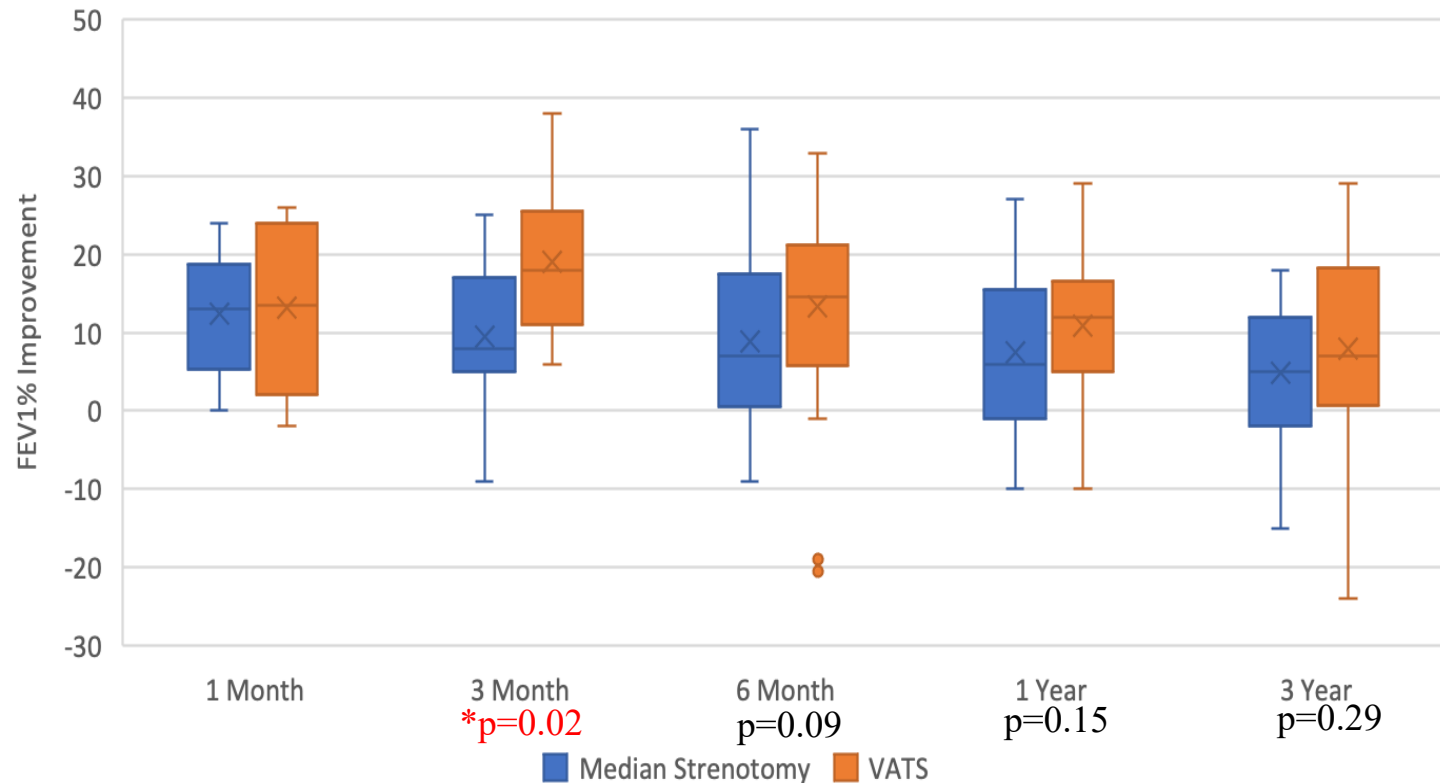
Post-operative FVC Improvement by Procedure Type



Significant
difference in
FVC
improvement
seen at 6 months,
1 year in VATS
group



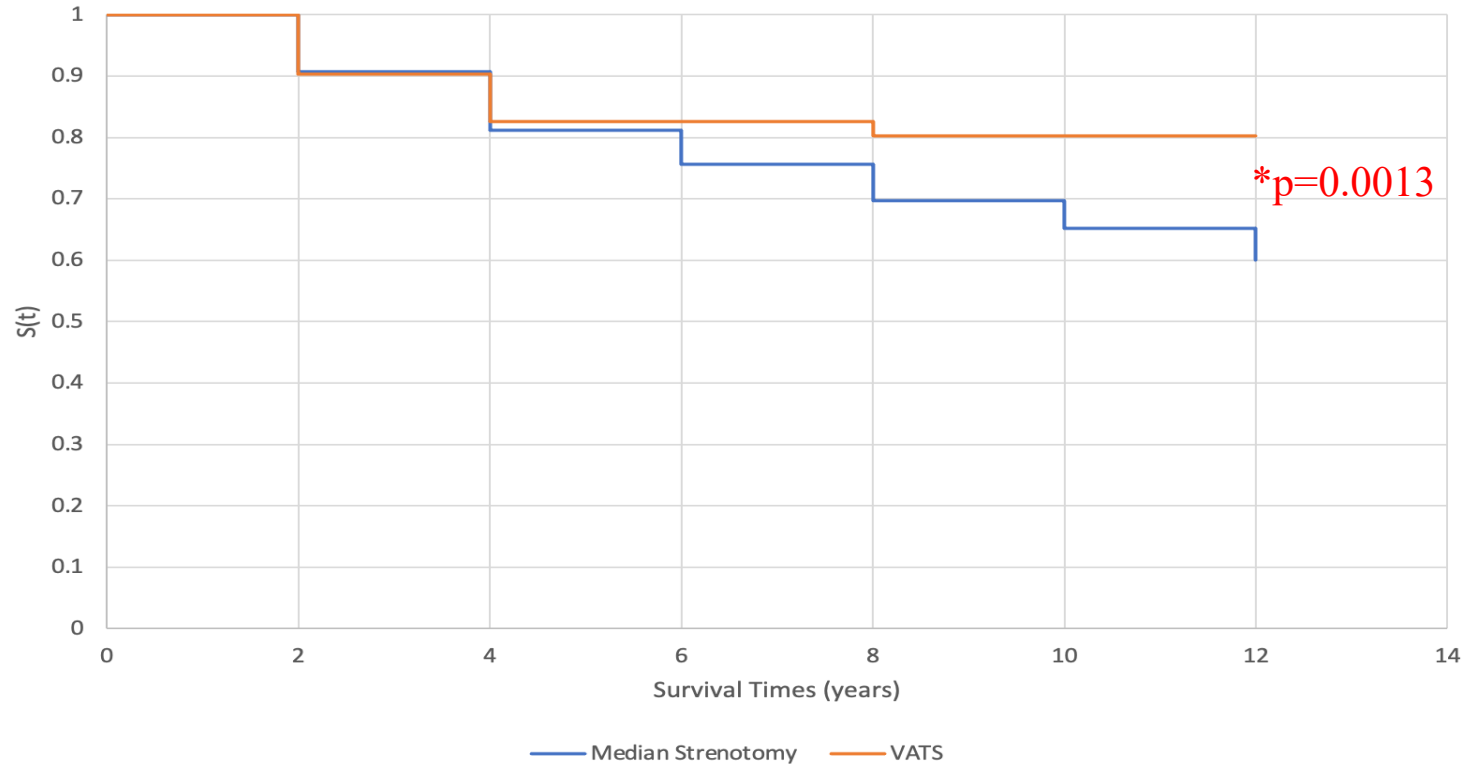
Post-operative FEV1% Improvement by Procedure



Significant
difference in
FEV1%
improvement only
seen at 3 months



Survival Curve by Procedure Type



VATS
showed
improved
survival at 12
years post-
LVRS when
compared to
MS



Conclusions

VATS showed improvement in post-operative FVC up to 1 year post-operatively when compared to MS

Patients undergoing LVRS had significant increases in post-operative FVC and FEV1% lasting up to 3 years post-surgery

VATS demonstrated improved survival rate 12 years post-surgery*



Thank you!
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