Predicted postoperative lung function – ***How low can we go ?***

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- Conventional guidelines
- Principles of lung volume reduction – patient selection
- Revised prediction of ppoFEV1
- Operative risk
- Long term survival
- Surgery vs radiotherapy

Conventional Guidelines

Guidelines on the Radical Management of Patients with Lung Cancer
British Thoracic Society and the Society for Cardiothoracic Surgery in Great Britain and Ireland
Thorax 2010;65(Suppl III):iii1eiii27.

- 42. Measure lung **carbon monoxide transfer factor** in all patients
- regardless of spirometric values. [C]
- 43. Offer surgical resection to patients with low risk of
- postoperative dyspnoea. [C]
- 44. Offer surgical resection to patients at moderate to high risk
- of postoperative dyspnoea if they are aware of and accept the
- risks of dyspnoea and associated complications. [D]
- 45. Consider using **ventilation scintigraphy or perfusion**
- **scintigraphy** to predict postoperative lung function if a ventilation
- or perfusion mismatch is suspected. [C]
- 46. Consider using quantitative CTorMRI to predict postoperative
- lung function if the facility is available. [C]
- 47. Consider using shuttle walk testing as functional assessment
- in patients with moderate to high risk of postoperative
- dyspnoea using a distance walked of >400 m as a cut-off for
- good function. [C]
- 48. Consider cardiopulmonary exercise testing to measure peak
- oxygen consumption as functional assessment in patients with
- moderate to high risk of postoperative dyspnoea using >15 ml/
- kg/min as a cut-off for good function. [D]

- The 2001 BTS guidelines were based on a lower limit of ppoFEV1 of 40%,
- but studies have since reported poor correlation between ppo FEV1 and TLCO with composite quality of life score.

Win T, Chest 2005;127:1159e65

- **Currently there are few data that provide guidance on a lower limit of lung function which predicts an acceptable degree of postoperative dyspnoea and quality of life.**

Lung volume reduction

Long-term follow-up .

- 1218 randomized patients
  overall 5 year survival advantage for LVRS,
  RR for death of 0.86 ($p = 0.02$).
- **upper-lobe low exercise capacity**
  improved survival (5-year RR, 0.67; $p = 0.003$), exercise at 3 years ($p < 0.001$), and SGRQ through 5 years ($p < 0.001$ years 1 to 3, $p = 0.01$ year 5).
- **upper-lobe high-exercise-capacity**
  no survival advantage but improved exercise capacity ($p < 0.01$ years 1 to 3) and SGRQ ($p < 0.01$ years 1 to 4).

Naunheim KS, Ann Thorac Surg. 2006 Aug;82(2):431-43.

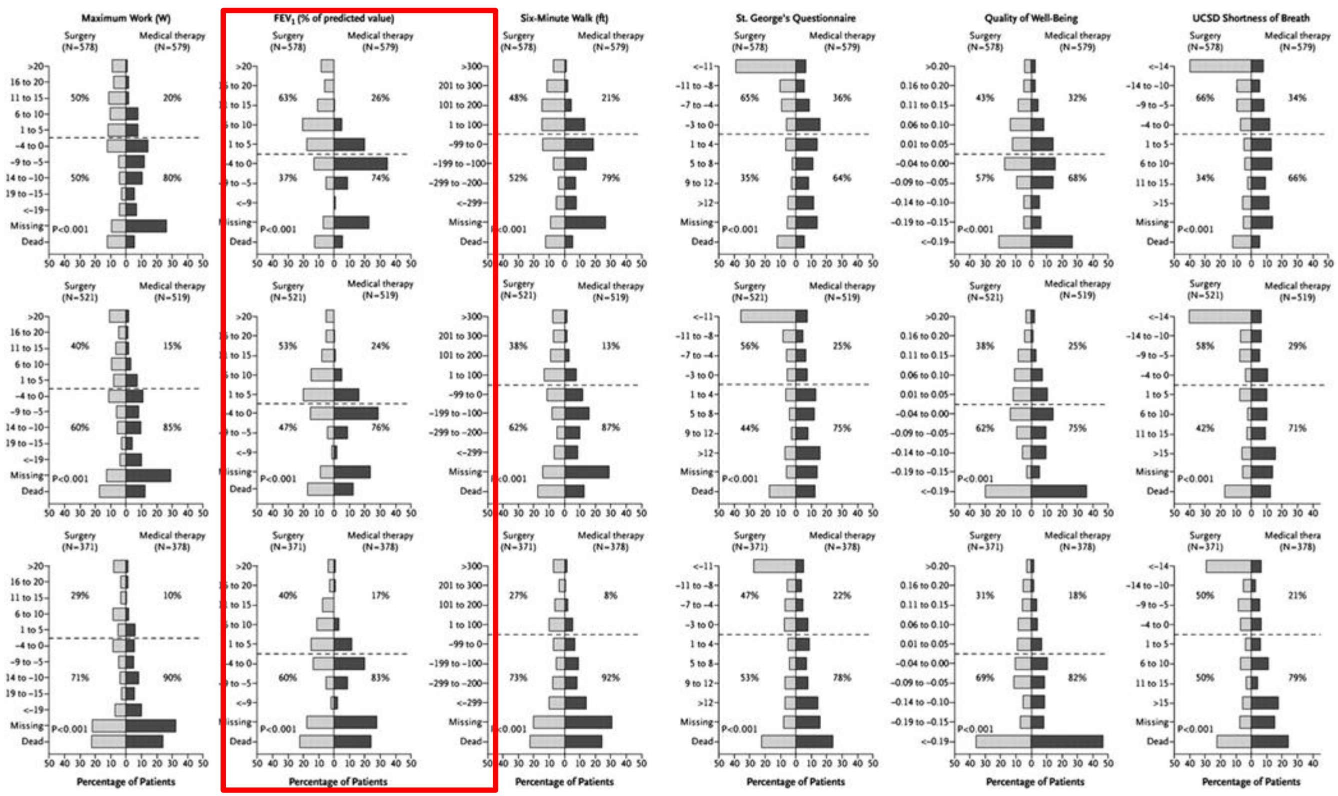
changes from baseline in exercise capacity, FEV1, 6 minute walk, SGRQ, quality of life and dyspnea

FEV1

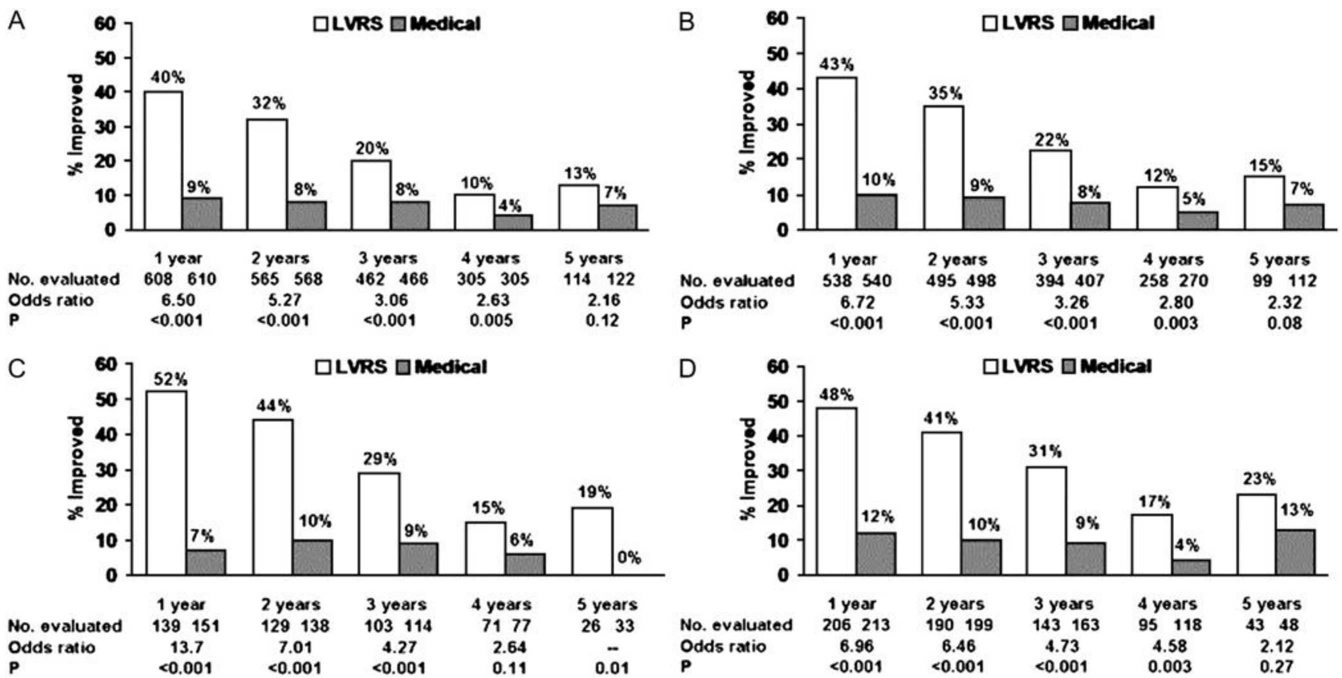
6 mo

12 mo

24 mo

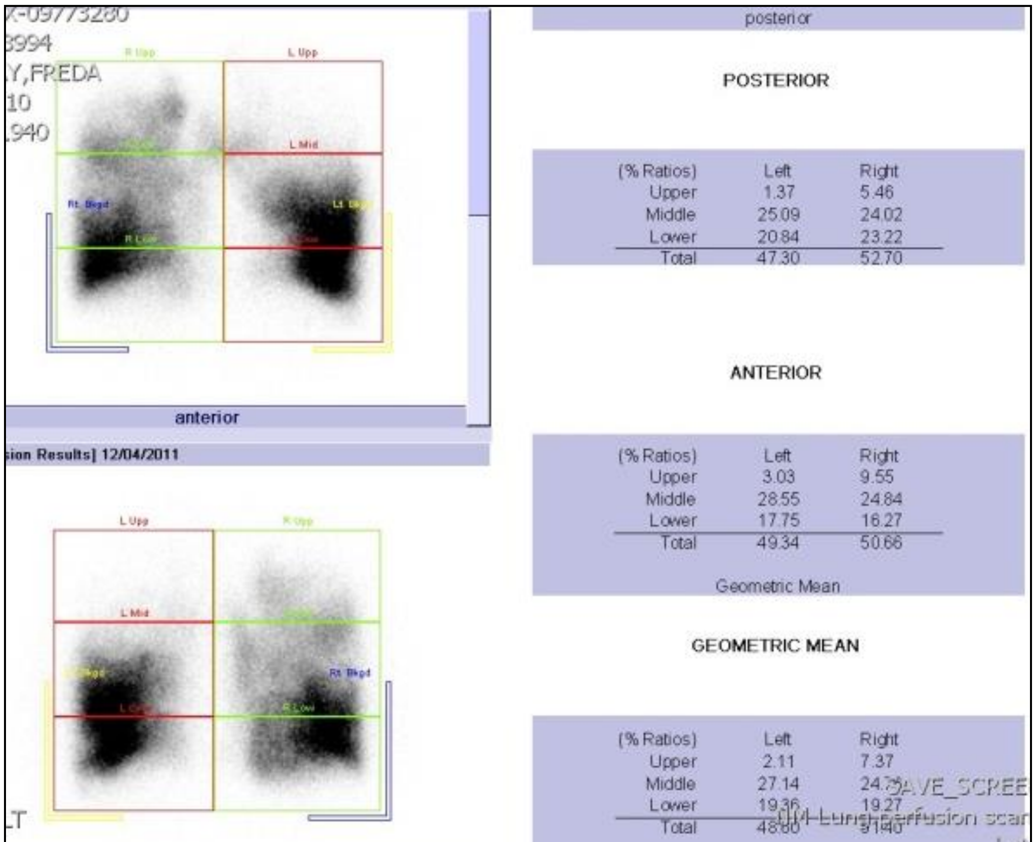


Sustained improvement in health-related quality of life (St. George's Respiratory Questionnaire) at 1, 2, 3, 4, and 5 years after randomization to LVRS



- 64 yr old smoker
- LUL SPN
- Severe COPD
- FEV_1 800ml (29% pred)
- $ppoFEV_1$ 22%

FEV1	RV	TLC	DLCO	KCO	pO2	pCO2
29%	220%	126%	35%	54%	8.2 KPa	4.3 KPa



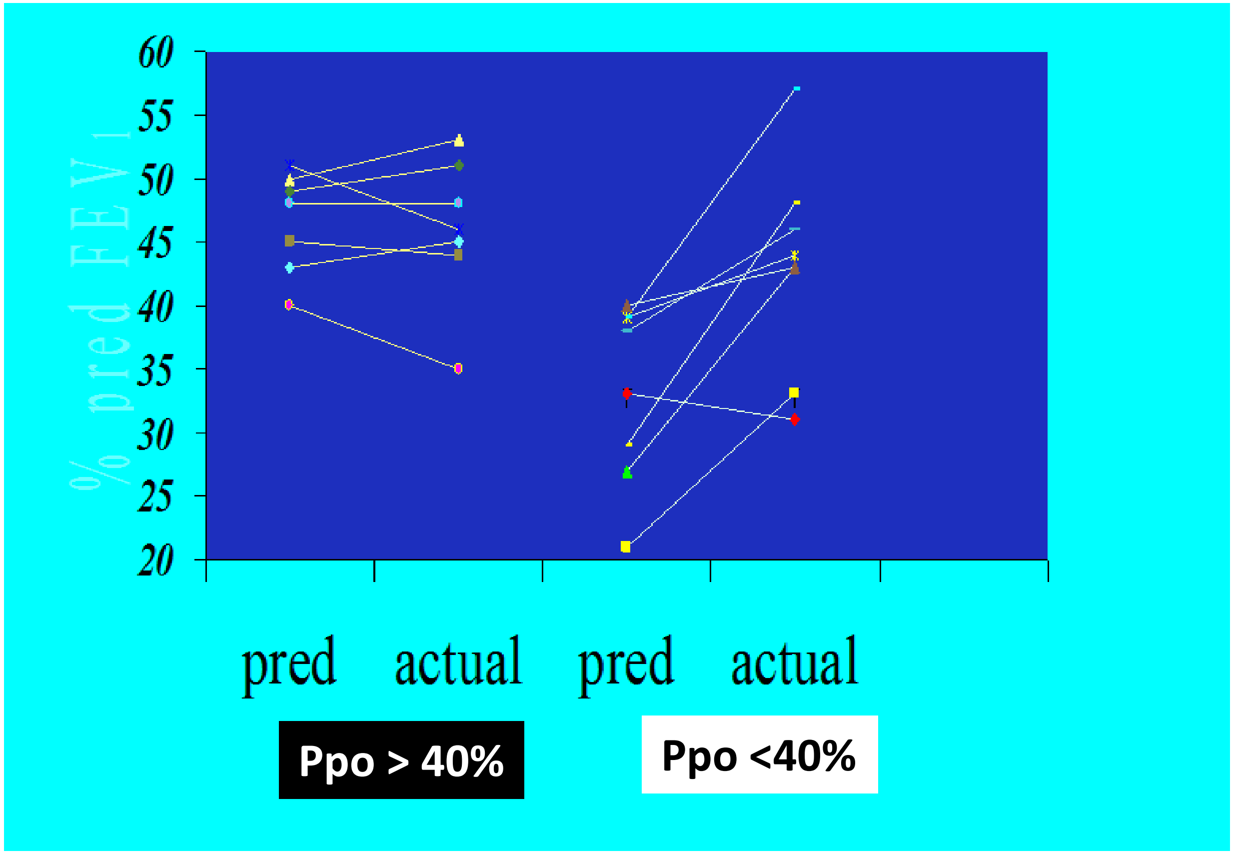
Applying LVRS to lung cancer resection

- **McKenna** RJ Jr, Fischel RJ, Brenner M, Gelb AF. Combined operations for lung volume reduction surgery and lung cancer. *Chest. 1996;110:885-8*
- **DeMeester** SR, Patterson GA, Sundaresan RS, Cooper JD. Lobectomy combined with volume reduction for patients with lung cancer and advanced emphysema. *J Thorac Cardiovasc Surg. 1998;115:681-8*
- **Korst** RJ, Ginsberg RJ, Ailawadi M, Bains MS, Downey RJ Jr, Rusch VW, Stover D. Lobectomy improves ventilatory function in selected patients with severe COPD. *Ann Thorac Surg. 1998;66:898-902*.
- **Carretta** A, Zannini P, Puglisi A, Chiesa G, Vanzulli A, Bianchi A, Fumagalli A, Bianco S. Improvement of pulmonary function after lobectomy for non-small cell lung cancer in emphysematous patients. *Eur J Cardiothorac Surg. 1999;15:602-7.*

Thorax. 2001 Oct;56(10):791-5.
Lobar volume reduction surgery: a method of increasing the lung cancer resection rate in patients with emphysema.
Edwards JG, Duthie DJ, Waller DA

	Lobar LVRS	Lobectomy - control	
Preop FVC % pred	71.8 (63–93)	79.3 (66–97)	0.06
Postop FVC % pred	64.4 (40–84)	65 (46–88)	NS
Preop FEV1 (lit)	**1.0 (0.68–1.5)**	1.63 (0.9–2.65)	0.001
Postop FEV1 (lit)	1.02 (0.65–1.25)	1.31 (0.75–2.3)	0.06
Perioperative change in FEV1 (lit)	0.06 (–0.37–0.34)	–0.27 (–0.54–0)	0.001
Predicted postoperative FEV1 (% pred)	**31.4 (16–39)**	47.3 (40–56)	0.0001
Actual postoperative FEV1 (% pred)	41.5 (18–57)	46.6 (30–61)	NS

Lobar LVRS for cancer

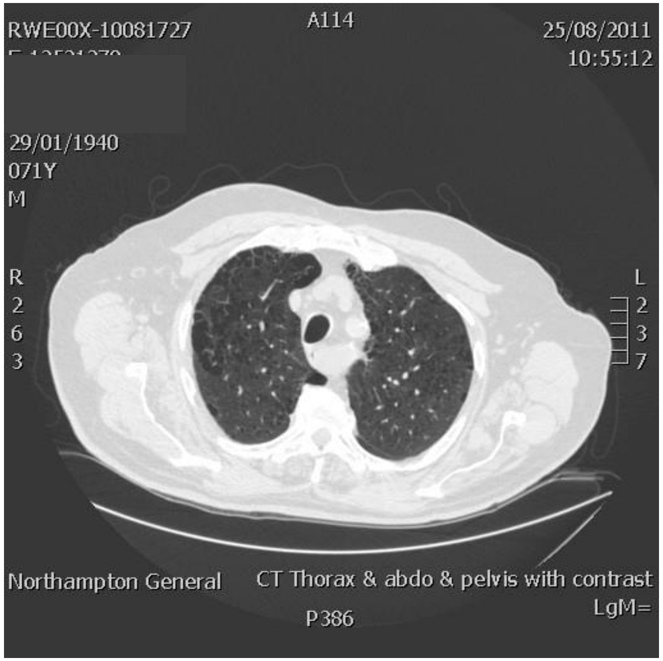


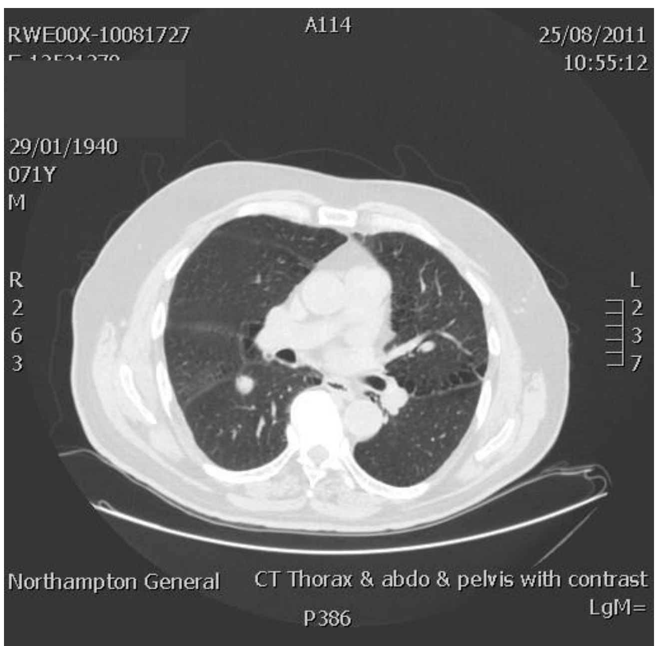
ACCP Evidenced-Based Clinical Practice Guidelines
(2nd Edition)
Colice et al, Chest 2007; 132:161S-177

- **In patients with very poor lung function and a lung cancer in an area of upper lobe emphysema, it is recommended that combined LVRS and lung cancer resection be considered if both the FEV_1 and the DLCO are > 20% predicted.**

- Patient fulfilled selection criteria for LVRS
- Hyperinflation, preserved gas exchange, apical underperfused target areas
- Surgery can be undertaken
- Is an open lobectomy the best operation ?
- In patients with a ppo $FEV_1 < 70\%$, segmentectomy offers no functional advantages over lobectomy.

Kashiwabara K, J Thorac Oncol. 2009;4:1111-6
Relationship between functional preservation after segmentectomy and volume-reduction effects after lobectomy in stage I non-small cell lung cancer patients with emphysema.





- 71yr old male
- **Upper** lobe COPD
- **Lower** lobe tumour
- ppoFEV_1 post lobectomy 32%
- Can’t use lobar LVRS effect

Consider combined upper lobe LVR + lower lobe segmentectomy

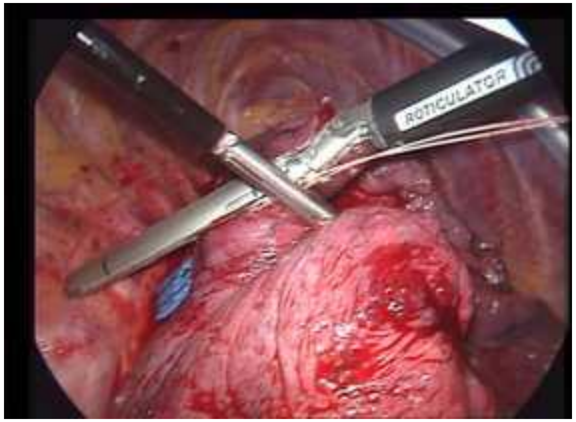
Lung cancer surgery in the breathless patient

- 84 patients (56M:28F, age 69 years)
  median preop FEV_1 41%
  median ppo FEV_1 32.8% (14-40%)
- control group :
  35 open lobectomy
- study group :
  27 open/ 4 VATS segmentectomy,
  18 VATS lobectomy

Lau KK, Martin-Ucar AE, Nakas A, Waller DA.

Eur J Cardiothorac Surg. 2010;38:6-13.

Lung cancer surgery in the breathless patient



- After segregating surgical approach and the extent of resection,
- ***the VATS approach was identified as the critical factor conferring survival advantage***
- HR 2.78, 95% CI: 1.21-6.3 7, p=0.016

Operative risk / survival

LVRS Mortality predictors

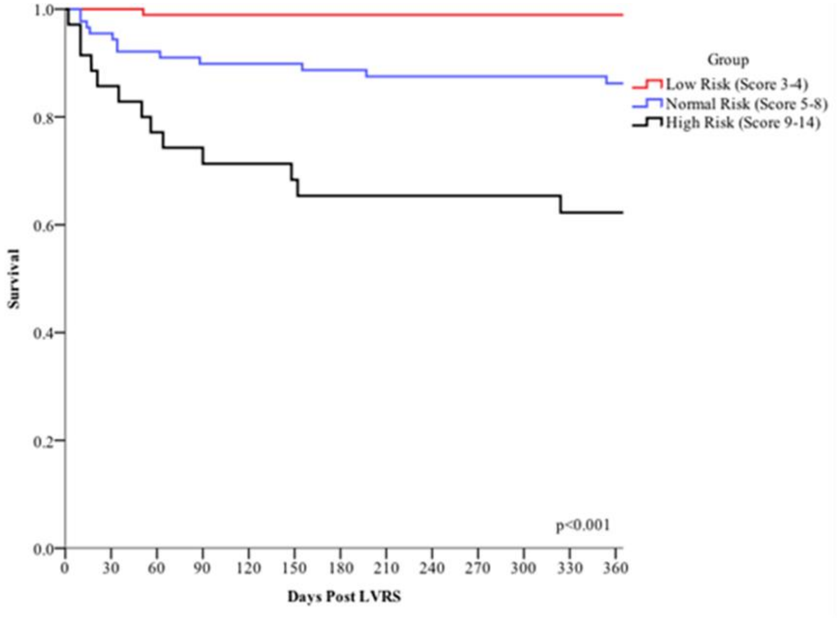
Variable	Survivors	Died	Total	p value
Age	60.10 (7.01)	61.76 (8.31)		0.310
Gender (% Male)	60.6%	66.7%	61.2%	0.589
MRC Grade N=68	4 (IQR 1)	4.5 (IQR 3)	4 (IQR 1)	0.111
Underweight (% <18.5)	**17.6%**	**42.9%**	19.8%	0.006
Home Oxygen (% Yes) N=160	29.1%	41.7%	30.0%	0.359
BMI	23.45 (4.18)	21.76 (5.32)		0.110
PaO2	9.61 (1.31)	9.39 (1.42)		0.484
PaCO2	5.28 (0.65)	5.18 (0.83)		0.557
FEV1 (%)	**28.74 (10.30)**	**23.52 (5.86)**		0.023
FEV1 (absol)	0.81 (0.34)	0.67 (0.34)		0.068
FEV1 (% <0.71)	46.4%	85.7%	50.0%	0.001
FVC (%)	72.42 (18.41)	63.00 (20.18)		0.028
FVC (absol)	2.53 (0.86)	1.94 (0.47)		0.002
TLC (%)	142.66 (17.40)	138.76 (15.82)		0.326
TLC (absol)	8.43 (1.55)	7.76 (1.43)		0.060
RV (%)	261.12 (53.54)	259.52 (45.76)		0.895
RV/TLC (%)	66.37 (9.00)	71.09 (6.49)		0.023
DLCO (%)	**39.00 (13.15)**	**31.05 (20.24)**		0.016

LVRS – composite risk score

		Score
BMI (kg/m^2)	18.5 or more	1
	< 18.5	3
DLCO (%pred)	**41% or more**	**1**
	20 - 40%	**2**
	< 20%	**6**
FEV_1 (L)	**0.7 or more**	**1**
	< 0.7	**5**

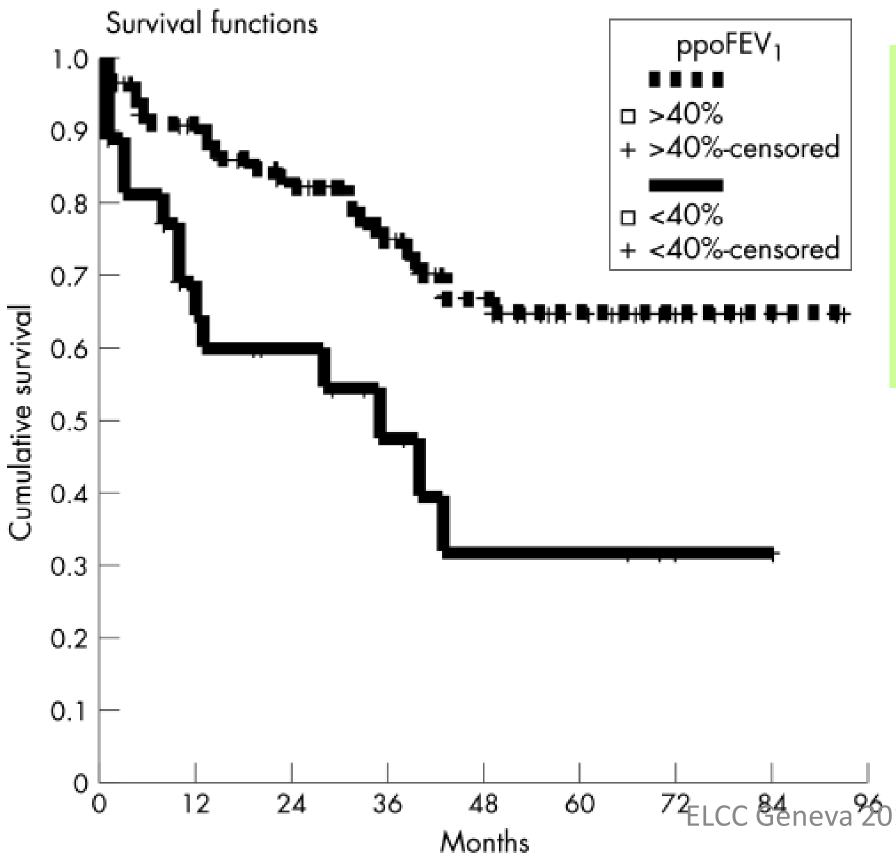
LVRS – differential survival

	Low n=94	Medium n=89	High n=35
Score	**3-4**	**5-8**	**9-14**
30 Day	0	4.5%	14.3%
90 Day	1.1%	10.1%	28.6%
1 Year	1.1%	13.5%	37.1%



Long-term survival after lobar LVRS for stage I lung cancer is limited by physiological rather than oncological factors

	Lobar LVRS	Lobectomy	
Mean (SE) actuarial 3 year survival*	48 (11)%	75 (4)%	0.001
Mean (SE) actuarial 5 year survival*	35 (11)%	65 (5)%	0.001



Is the initial feasibility of lobectomy for stage I non-small cell lung cancer in severe heterogeneous emphysema justified by long-term survival?

Martin-Ucar AE, Edwards JG, Waller DA. Thorax. 2007;62:577-80

Alternatives to surgery

Disadvantages of radiotherapy compared with surgery

At best, stereotactic body radiation therapy can only approximate a **wedge resection** if it is assumed that 100% tumour destruction has occurred.

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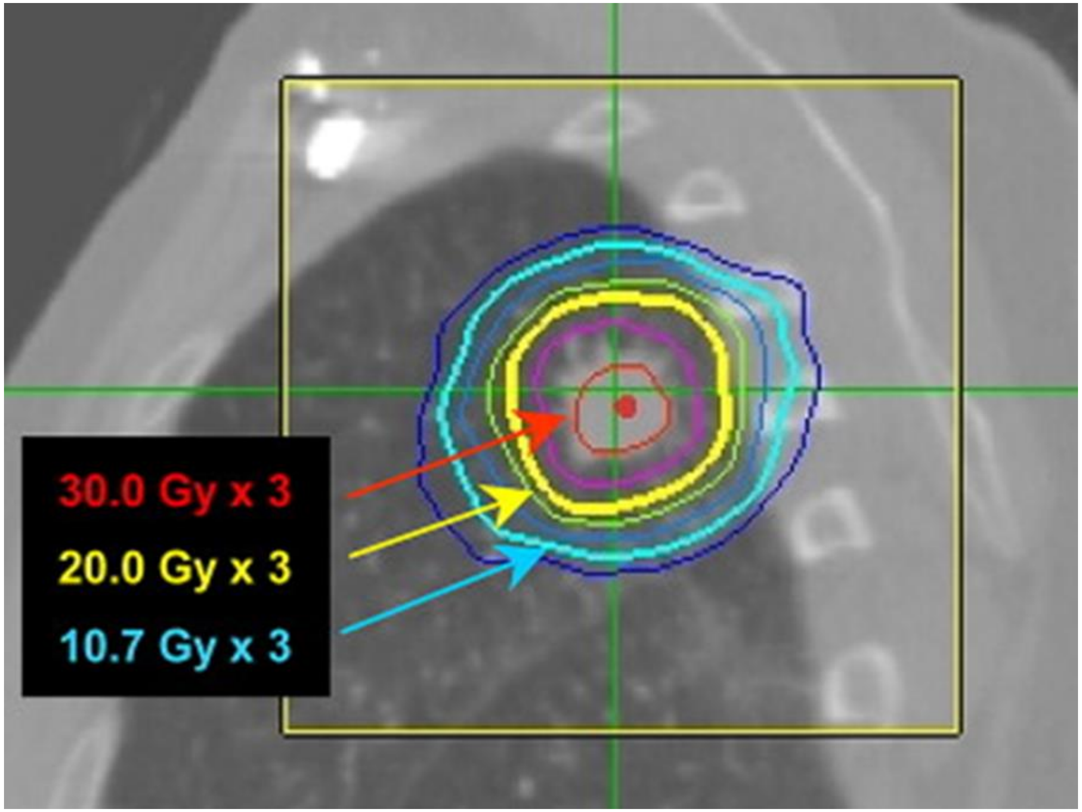
Fernando HC, Schuchert M, Landreneau R, Daly BT. Approaching the high-risk patient: sublobar resection, stereotactic body radiation therapy, or radiofrequency ablation. Ann Thorac Surg. 2010 ;89:S2123-7.



“SABR is a less risky equivalent of wedge resection for patients whose life expectancy is likely to be limited by their co-morbidity rather than lung cancer”

Summary

- Use the principles of **lung volume reduction** surgery to extend the selection criteria for lung cancer resection
- Extensive **preoperative investigation** is imperative
- An appreciation of the differential effects on life expectancy of the **primary tumour vs co-morbidities**