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Segmentectomy. Is it justified in European grounds?

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Historical aspects

Segmentectomies reported since 70s' with over 50% 5 year survival

1. 1982: Initiation 247 eligible patients
2. 1988: closure
3. Randomized lobectomy versus Segmentectomy and wedges
4. All early cancers
5. Minimum follow up 4.5 years
6. All open cases

Randomized trial of Lobectomy Versus Limited Resection for T1N0M0 Non-Small Cell Lung Cancer. Lung Cancer Study group. Annals of Thoracic Surgery: 1995

Historical aspects

1. Death rate per year 30% higher in sub lobar group
2. Loco regional recurrence in sub lobar group 300% higher (p=0.008). 17% in true figures
3. Relative worse in wedge resections compared with segmentectomies

Randomized trial of Lobectomy Versus Limited Resection for T1N0M0 Non-Small Cell Lung Cancer. Lung Cancer Study group. Annals of Thoracic Surgery: 1995

Historical aspects

1. DATA SCRUTINY

   Small group of patients
   No histological differentiation
   Mixed ‘bag’ of segments and wedges
   Open surgery
   Marginal differences to draw firm conclusions

Randomized trial of Lobectomy Versus Limited Resection for T1N0M0 Non-Small Cell Lung Cancer. Lung Cancer Study group. Annals of Thoracic Surgery: 1995

Historical aspects

1. **Interesting observation**

   Better preservation of lung function and

   Possibly reduced morbidity with:

   a. < complication rates
   b. shorter Hospital stay
   c. better preserved breathing capacity

Randomized trial of Lobectomy Versus Limited Resection for T1N0M0 Non-Small Cell Lung Cancer. Lung Cancer Study group. Annals of Thoracic Surgery: 1995

Evolution

Why have sub lobar resections become popular again?

1. **VATS POPULARITY. The minimally invasive thinking**
2. **Need for operating frail, elderly, high risk patients**
3. **Screening programs with early cancers**

WITHOUT FORGETTING NEED TO PERFORM AN APPROPIATE CANCER OPERATION

The quest to answer the question

14 studies

From: Survival following lobectomy vs limited resection for stage I lung cancer: a meta-analysis

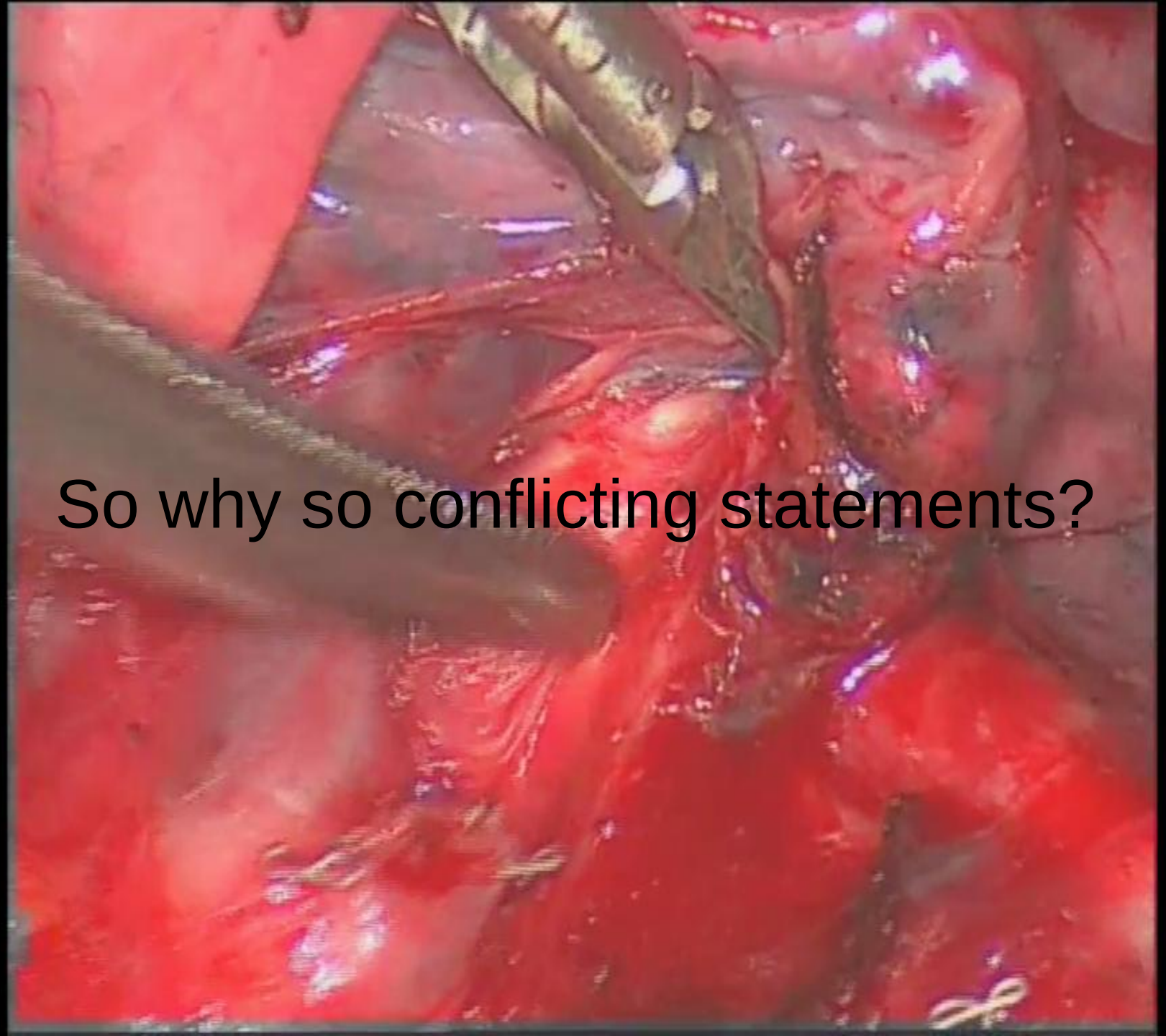
Authors	Study design	Stage	No. of limited resection	No. of lobectomy	Reasons for limited resection	Survival difference
Hoffmann and Ransdell (1980)	RS	IA	33 (W)	40[a]	Poor cardiopulmonary function and smaller lesions	NS
Read et al (1990)	RS	IA	113 (107S+6W)	131	ND	NS (CSS)
Date et al (1994)	MPS	IA	16 (6S+10W)	16	Poor pulmonary function	Lobectomy better
Warren and Faber (1994)	RS	IA+B	66 (S)	103	Poor cardiopulmonary function and smaller lesions	Lobectomy better
Harpole et al (1995)	RS	IA+B	75 (W)	193	Poor cardiopulmonary function and smaller lesions	NS (CSS)
LCSG (1996)	RCT	IA	122 (82S+40W)	125	Randomisation	NS
Kodama et al (1997)	RS	IA	46[b] (W)	77	Intentional resection for small lesions	NS
Landreneau et al (1997)	RS	IA	102 (W)	117	Poor cardiopulmonary function	NS
Pastorino et al (1997)	RS	IA+B	53 (S+W)	367	ND	NS
Kwiatkowski et al (1998)	RS	IA+B	58 (S+W)	186[c]	ND	Lobectomy better
Okada et al (2001)	RS	IA≤2 cm	70 (S)	139	Intentional resection for small lesions ≤2 cm	NS
Koike et al (2003)	RS	IA≤2 cm	74 (60S+14W)	159	Intentional resection for small lesions ≤2 cm	NS
Campione et al (2004)	RS	IA	21 (S)	100	Poor cardiopulmonary function	NS
Keenan et al (2004)	RS	IA+B	54 (8)	147	Poor pulmonary function	NS

[a]Tumours peripherally located.
[b]Only intentional resection.
[c]Including 13 pneumonectomies.
LCSG=Lung Cancer Study Group; S=segmentectomy; W=wedge resection; ND=not described; NS=not significant; MPS=matched-pair study; RCT=randomised controlled trial; RS=retrospective study; CSS=cancer-specific survival.

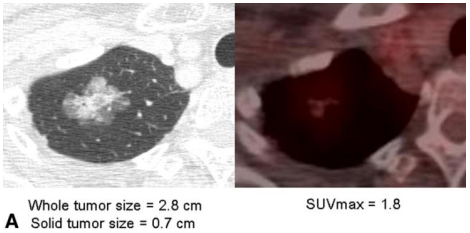
COMBINED SURVIVAL DIFFERENCE

YEARS	%
1	0.7
3	1.9
5	3.6

Survival following lobectomy *vs* limited resection for stage I lung cancer: a meta-analysis
H Nakamura, N Kawasaki, M Taguchi & K Kabasawa. 2005


So why so conflicting statements?

I can do a segmentectomy because



T Size, N stage and Histology is all that matters

Basic rules of cancer management must always apply

- Cancer prognosis depends on stage

- Overall 5-year survival was 79% for stage IA patients.
- Current smoking, diffusion capacity of lung for carbon monoxide less than 69%, **tumor size greater than 2 cm**, **N2 disease**, and **advanced histology grade** were associated with decreased survival by univariate analysis.
- In a multivariate model, **only tumor size greater than 2 cm** remained significant.
- Tumor recurrence was observed in 39 patients (35%): local in 17 patients (15%) and distant only in 22 (20%).
- For stage IA patients with T1a lesions, local recurrence was 5% and distant recurrence was 13%.
- Five-year recurrence-free survival of these patients was 69%.

Ann Thorac Surg. 2012 Feb;93(2):381-7
Oncologic efficacy of anatomic segmentectomy in stage IA lung cancer patients with T1a tumors.
Donahue JM1, Morse CR, Wigle DA, Allen MS, Nichols FC, Shen KR, Deschamps C, Cassivi SD

1.Pre operative staging and invasiveness matters

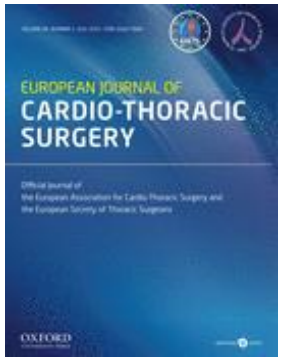
- **HOW IS Early stage lung cancer DEFINED?**

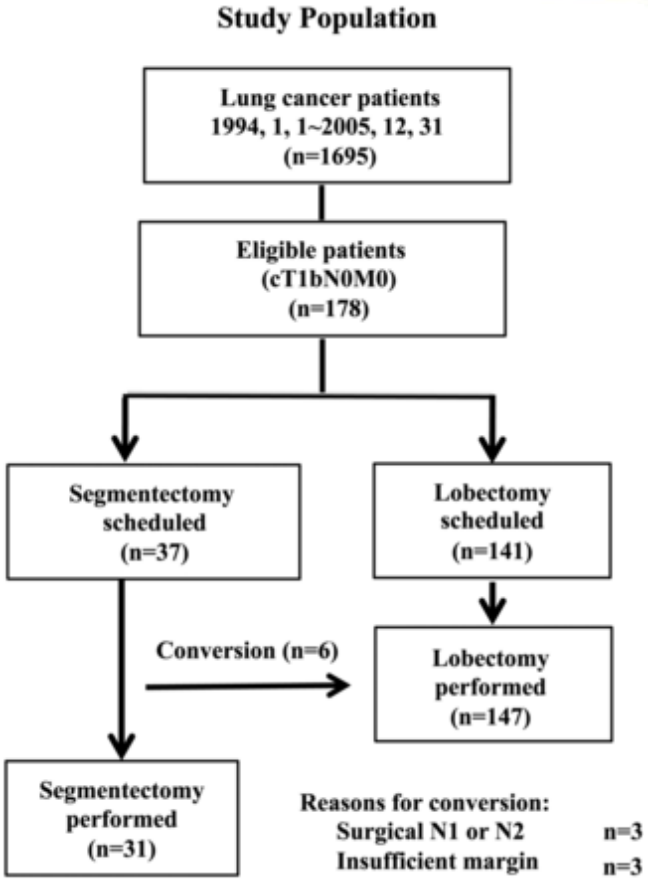
a. Good correlation between tumor SUV, node SUV and final staging
b. Good negative predictive value
c. False positive rates in N1 and N2 nodes 70% and 78%

- **PET scan mandatory**
- Trust negative results
- Stage positive results

- Confirm intra operatively with lymphadenectomy

Hsu WH, Lin KH, Wang SJ. Role of preoperative PET-CT in assessing mediastinal and hilar lymph node status in early stage lung cancer.
J Chin Med Assoc. 2012 May;75(5):203-8.

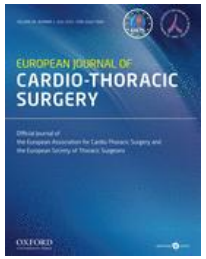


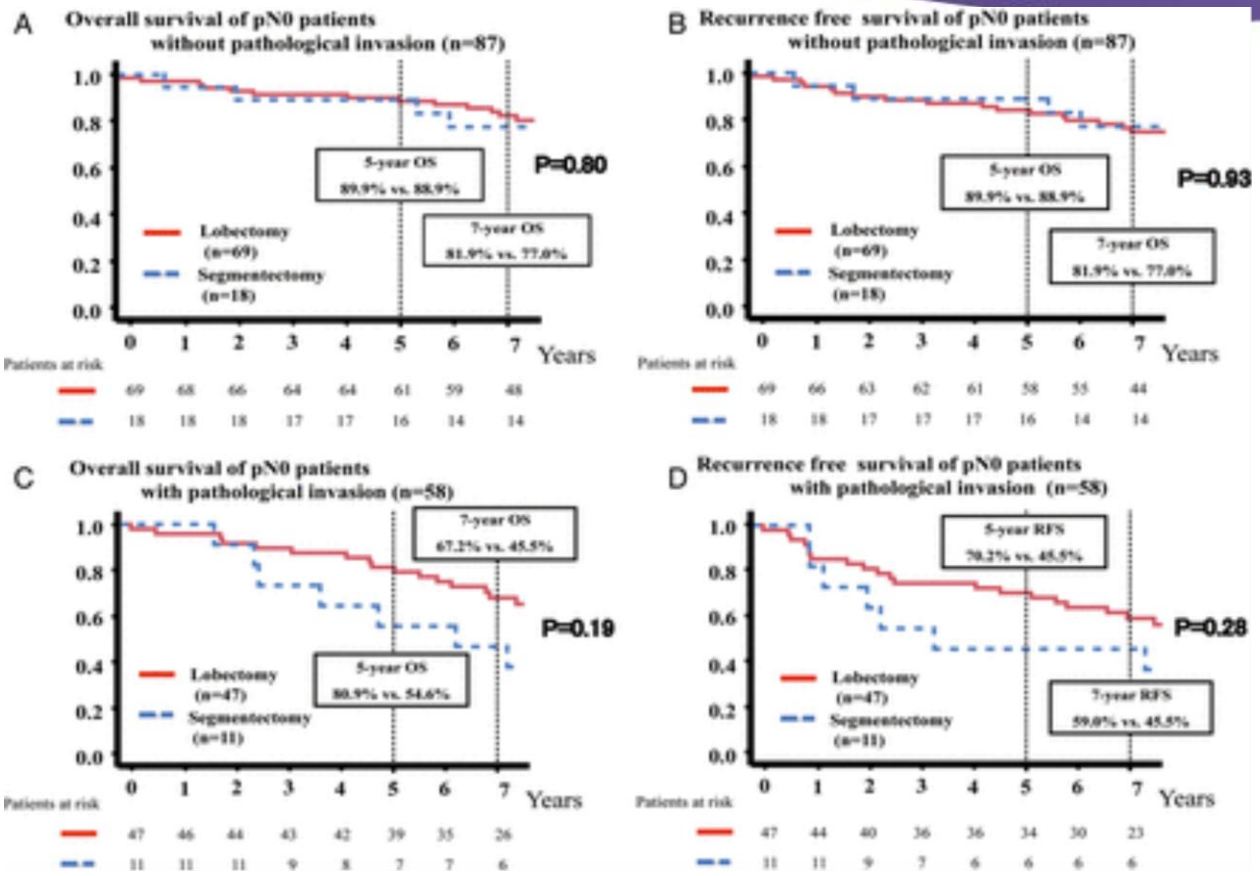


Outcomes of segmentectomy for cT1bN0M0 lung adenocarcinoma and squamous cell carcinoma: a possible association with pathological invasion

Hiroyuki Ogawa Kazuya Uchino Yugo Tanaka Nahoko Shimizu Yusuke Okuda Kenta Tane Daisuke Hokka Shinya Tane Shunsuke Tauchi Wataru Nishio

European Journal of Cardio-Thoracic Surgery, Volume 48, Issue 1, 1 July 2015, Pages 77–82





How to select these patients pre operatively?

From: Outcomes of segmentectomy for cT1bN0M0 lung adenocarcinoma and squamous cell carcinoma: a possible association with pathological invasion
Eur J Cardiothorac Surg. 2014;48(1):77-82.

FIGURE 1

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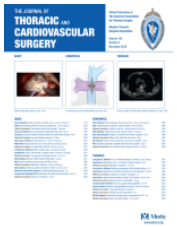
Conclusion

Radiologic non invasion correlates well with pathologic non invasion when solid element 25% of tumour diameter

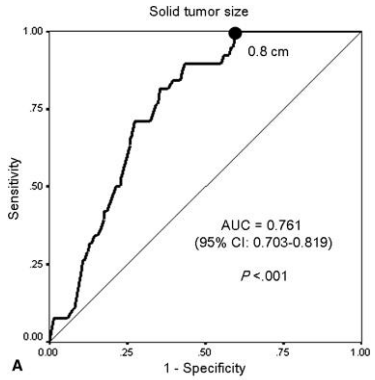
A Prospective Radiological Study of Thin-Section Computed Tomography to Predict Pathological Noninvasiveness in Peripheral Clinical IA Lung Cancer (Japan Clinical Oncology Group 0201) Kenji Suzuki, MD, et al. Journal of Thoracic Oncology
Volume 6, Issue 4, Pages 751-756 (April 2011)



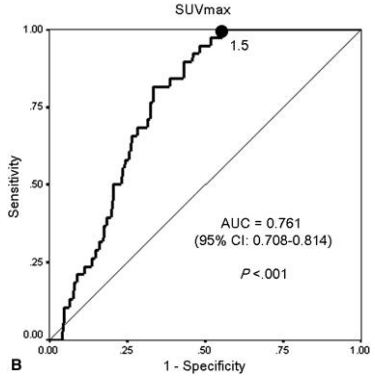
Prediction of pathologic node-negative clinical stage IA lung adenocarcinoma for optimal candidates undergoing sublobar resection

Yasuhiro Tsutani, MD, PhD, Yoshihiro Miyata, MD, PhD, Haruhiko Nakayama, MD, PhD, Sakae Okumura, MD, PhD, Shuji Adachi, MD, PhD, Masahiro Yoshimura, MD, PhD, Morihito Okada, MD, PhD

The Journal of Thoracic and Cardiovascular Surgery
Volume 144, Issue 6, Pages 1365-1371 (December 2012)

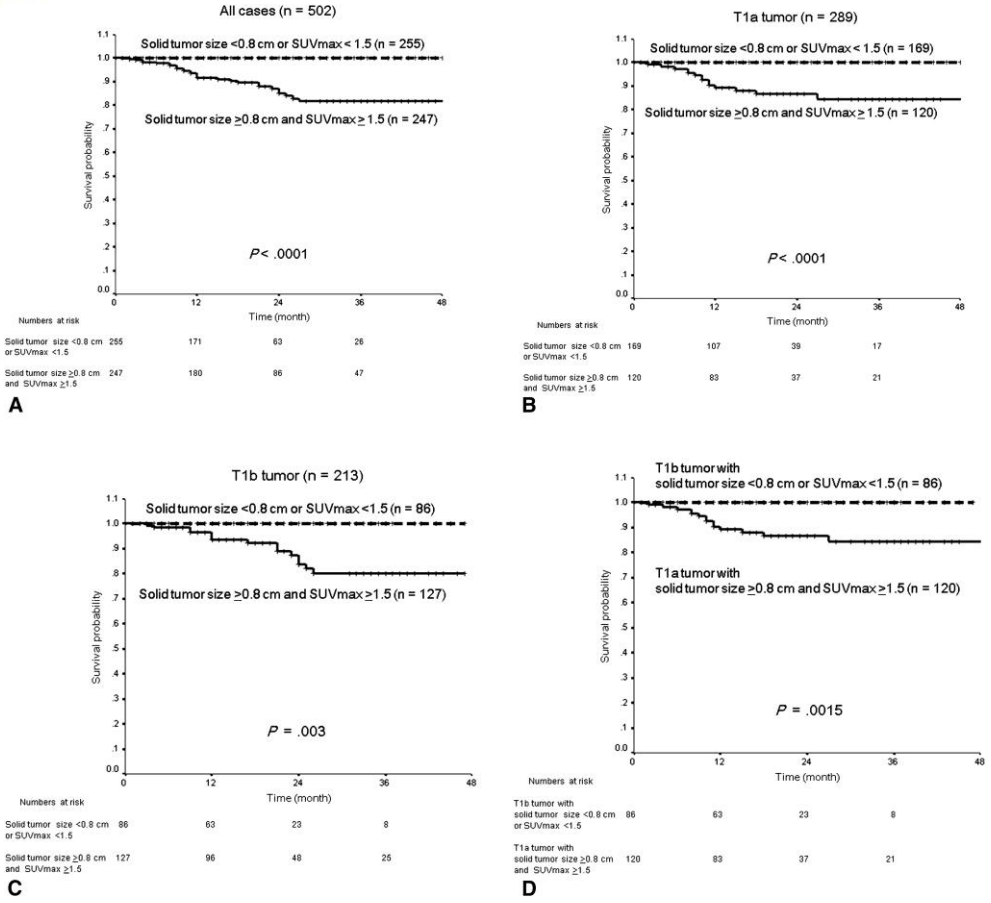


CT

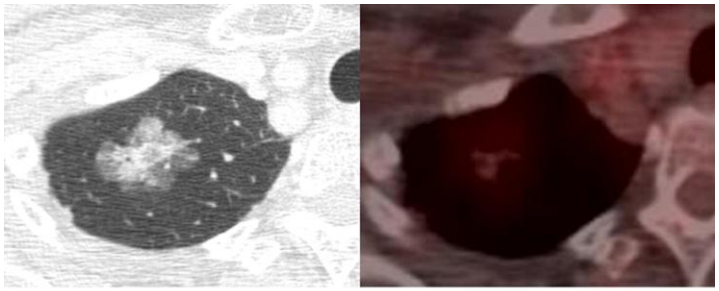


PET

Figure 2



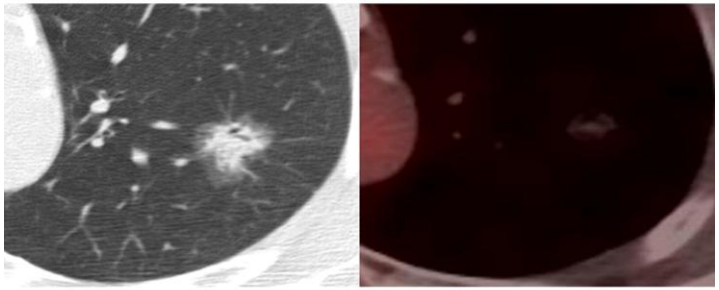
Sub lobar resection
No systemic lymph nodal
Dissection required



Whole tumor size = 2.8 cm
Solid tumor size = 0.7 cm

SUVmax = 1.8

A



Whole tumor size = 2.4 cm
Solid tumor size = 1.5 cm

SUVmax = 0.9

B

3 year Disease free Survival:

A. ALL CASES 100% AND 81.8%
B. T1a 100% and 84.2%
C. T1b 100% and 80.1%

2. Tumor size

- **De Zoysa et al: 2012. Interactive and Cardiovascular Surgery**
- **Fernando HC et al: 2005. J. Thorac Cardiovasc. Dis.**
- **Okada MJ et al: 2006. J Thor Cardiovasc Surgery**
- **Okumura M et al: 2007. Lung Cancer**
- **Varlotto JM et al: Chest 2013.**

- **OBSERVATIONS**

- **Tumors less than 2cm confer comparable survival between lobectomy and sub lobar resections**
- **Tumors over 30mm offer 21% difference in 5 year survival**
- **Histological grade offers difference in overall survival**

3. Resection margins

- Small study
- <1cm margin recurrence 14.6%
- >1cm margin recurrence 7.5%

Thoughts

- Is margin enough?
- Should margin correlate with size of tumor?
- Is lymphatic drainage the same in all lobes?
- Should inter lobar nodes define margin? Node mapping?

El Sherif et al: Annals of surgical oncology. 2007.

4. Type of limited resection and nodes

- Chamogeorgakis et al: 2009. Interact Cardiovasc Thorac Surg.

- Evidence supports wedge worse than lobectomy but comparable to Segmentectomy.

  Feasibility increases with VATS skills and morbidity decreases: Includes, chest tube duration, length of stay and post op complications.

- **NOTE: Evolution of technology to mark lesion and offer appropriate segmental resection.**
- **Lumph node pick up. 4%-7% even in early stage disease. Therefore lymphadenectomy is important**

5. Histology. Does it matter?

New classification of adenocarcinoma in relation to nodule

Term	Malignant potential	CT correlate
Atypical adenomatous hyperplasia (AAH)	Premalignant	Pure GGN < 5 mm
Adenocarcinoma in situ (AIS)	Premalignant	Pure GGN > 5-30 mm
Minimally invasive adenoCa (MIA)	Invasive part solid nodule	Solid area < 5 mm
Invasive adenoCa	Larger part solid nodule	Solid area > 5 mm

Small, node negative, GGO have 100% 5 year survival with limited resections

Rami-Porta et al: 2009. European Resp Journal

6. Other considerations

- Patient functional status and respiratory reserves
- Frail and elderly

The need for objective standardized data

1. **JCOG 0802/WJOG4607L**

   1100 Patients
   T1aN0 solid tumors at periphery
   Compare lobes with segments

2. **JCOG 0802/WJOG4507L**

   Subset with GGO's 300 cases

3. **CALGB Trial 140503**

   692 patients
   Includes wedges

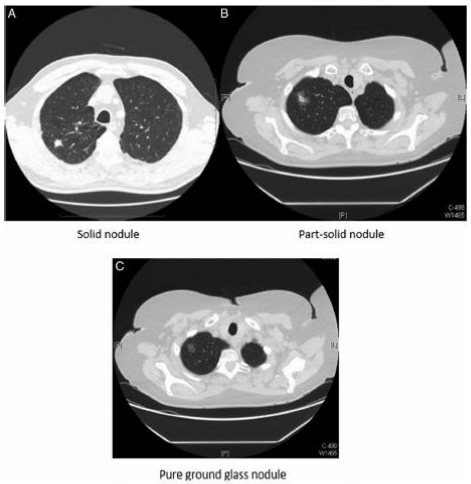
The future

- **Facts**

1. Sub lobar resections are feasible in a subgroup of patients.
2. Sub lobar resections are feasible in small and early tumors.
3. Sub lobar resections are possible when good margins can be guaranteed.

How do we define these patients?

Sub lobar resection chart



Images of nodules.

M E J Callister et al. Thorax 2015;70:ii1-ii54

THORAX

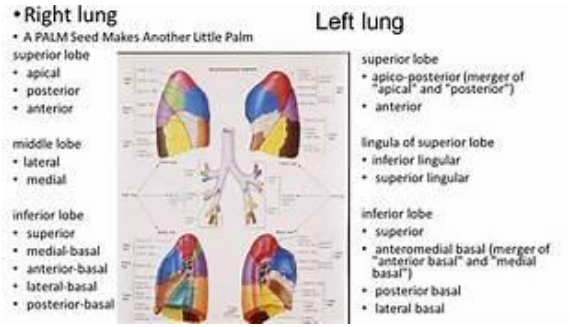
1. Tumour
    1. Size > or < than 2cm?
    2. Solid/non solid ratio
    3. SUV avidity
    4. Part of multi treatment modality?
    5. Margins secured by anatomy?
2. PET feel
    1. Low or high SUV?
3. Nodes
    1. PET negative accept?
    2. PET positive stage?
    3. N1 clear?
4. Patient Physiology
5. Surgical skills and available technology

Are we ready for sub lobar resections?

- 45 year old female.
- PS 0.
- No co morbidities
- 20mm solid tumor
- Adenocarcinoma
- PET negative for Nodes
- SUV 2.2

Question 1

- Lobe or segment?



Question 2

- Receives a segmentectomy
- Home day 3
- Histology report:
  - Non invasive Adeno Ca
  - No lymphatic invasion, no vascular invasion
  - Margins 3cm clear
  - Single L11 node positive

PLAN

1. **FOLLOW UP?**
2. **ADJUVANT CHEMO?**
3. **COMPLETION LOBECTOMY AND ADJUVANT CHEMO?**