



LANDESKRANKENHAUS FELDKIRCH

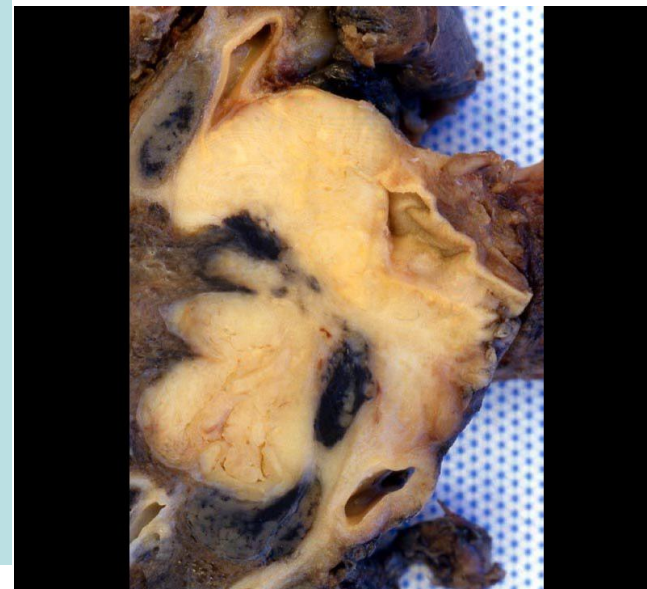
Akademisches Lehrkrankenhaus

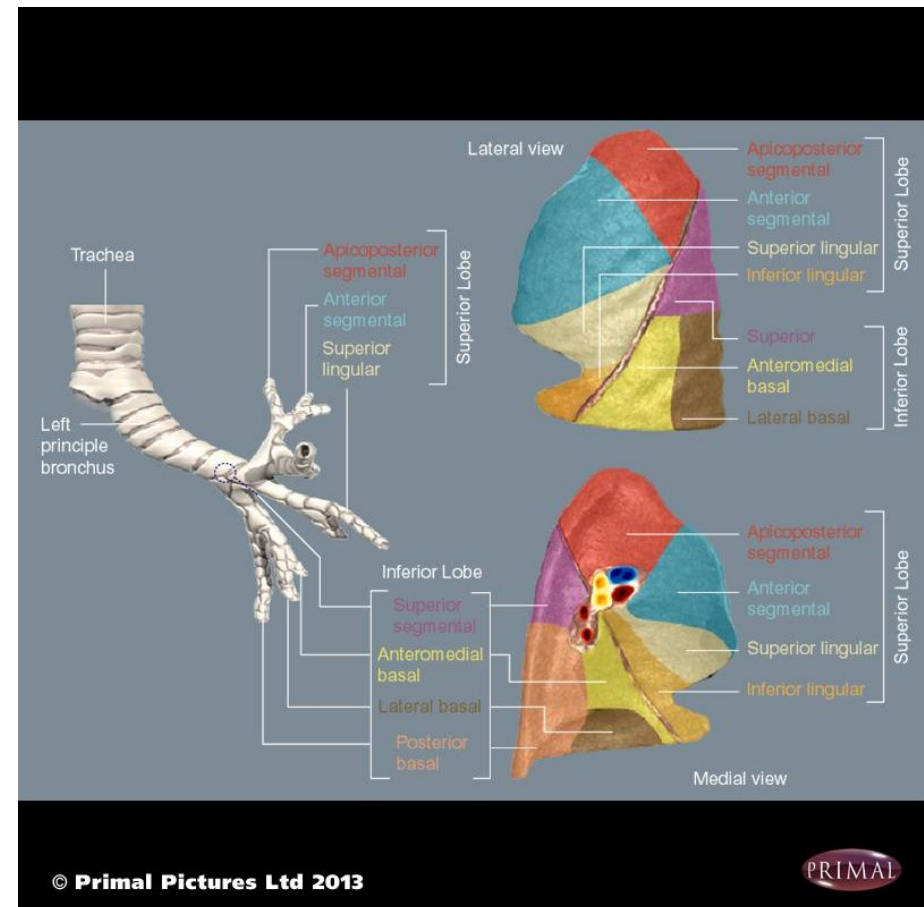
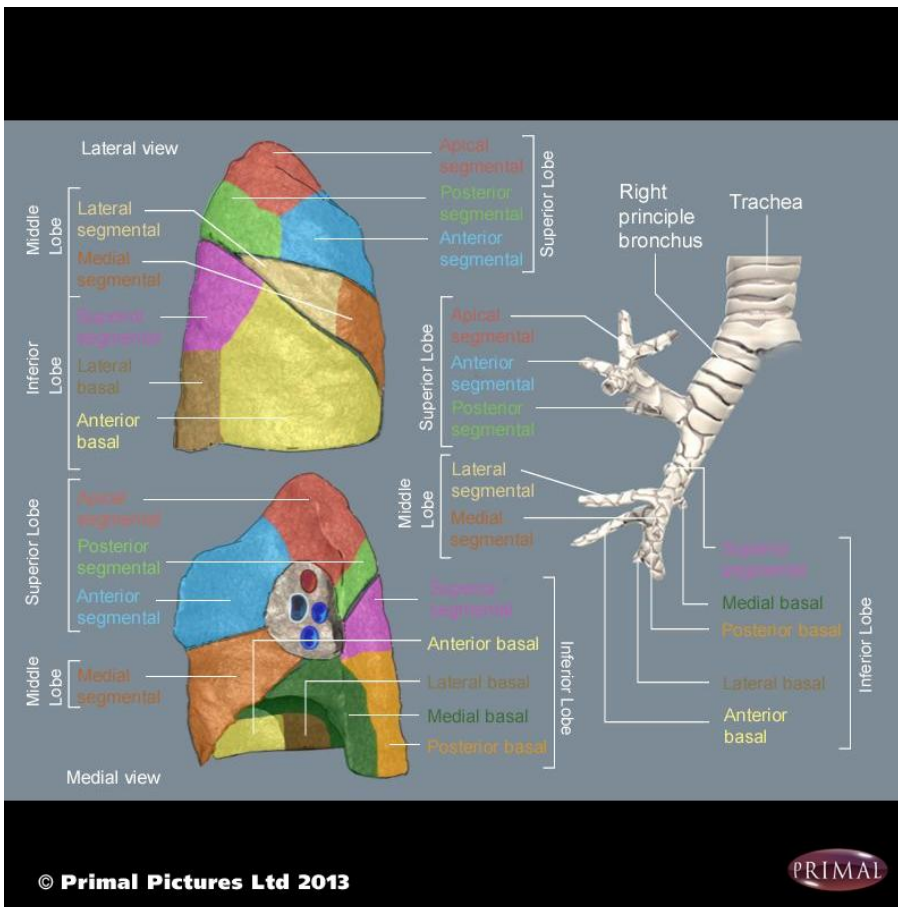


30.07.2015
**Lungenkrebs:
Zeitgemäße
chirurgische Therapie**

E. Wenzl

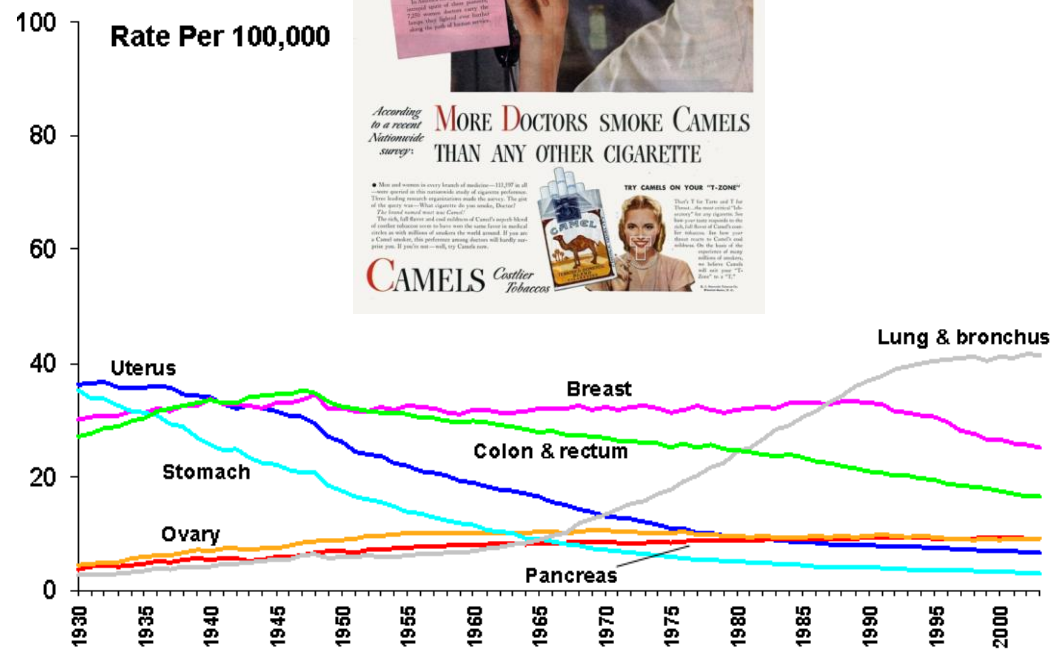
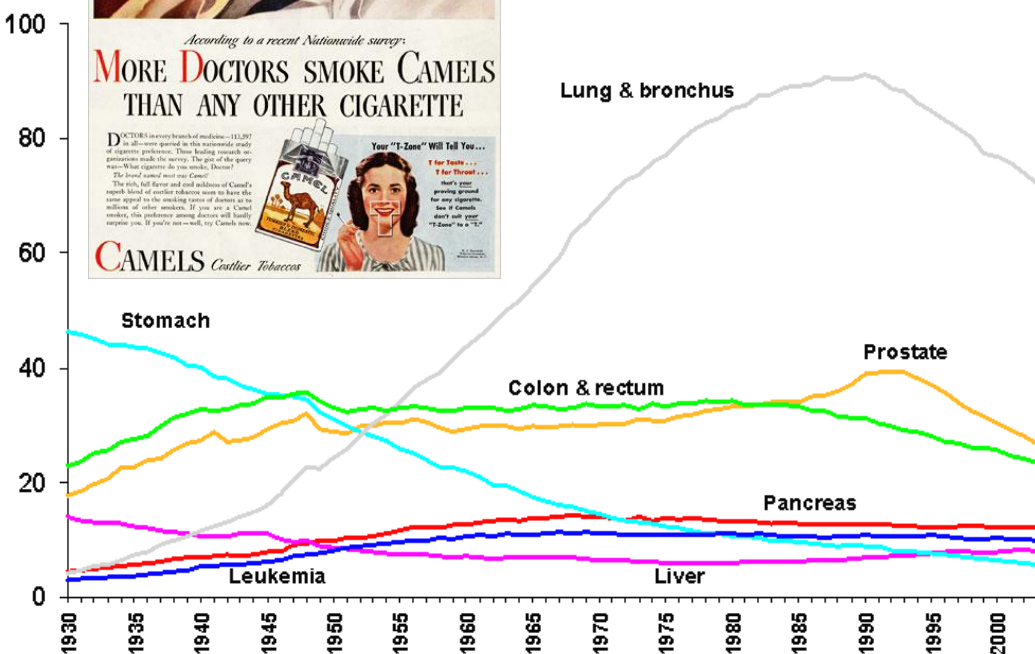
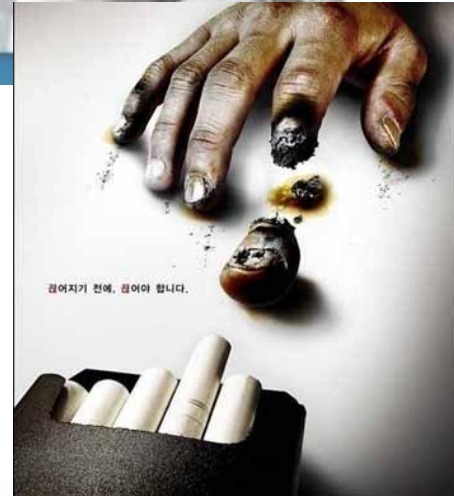
Abteilung für Allgemein-,
Viszeral- und Thoraxchirurgie
LKH Feldkirch
Akademisches Lehrspital





Bronchialkarzinom

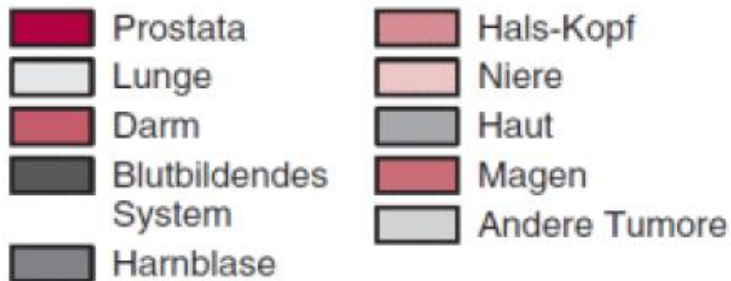
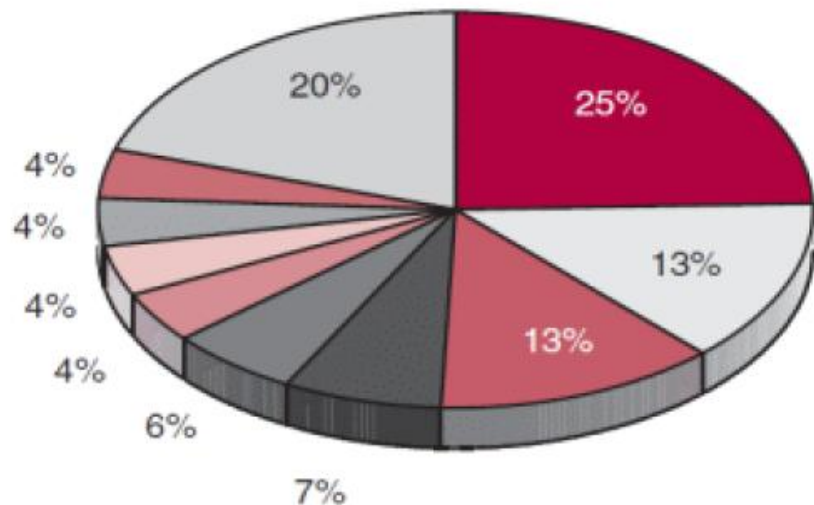
- Der Killer
- Mortalität USA (Am. Cancer Society)



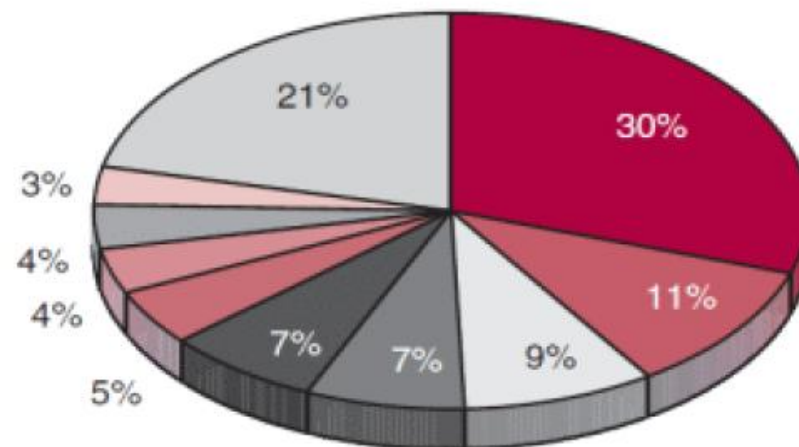
Bronchialkarzinom Epidemiologie

Die häufigsten Tumorlokalisationen nach Geschlecht (2011)

19.298 Männer = 100%



17.769 Frauen = 100%



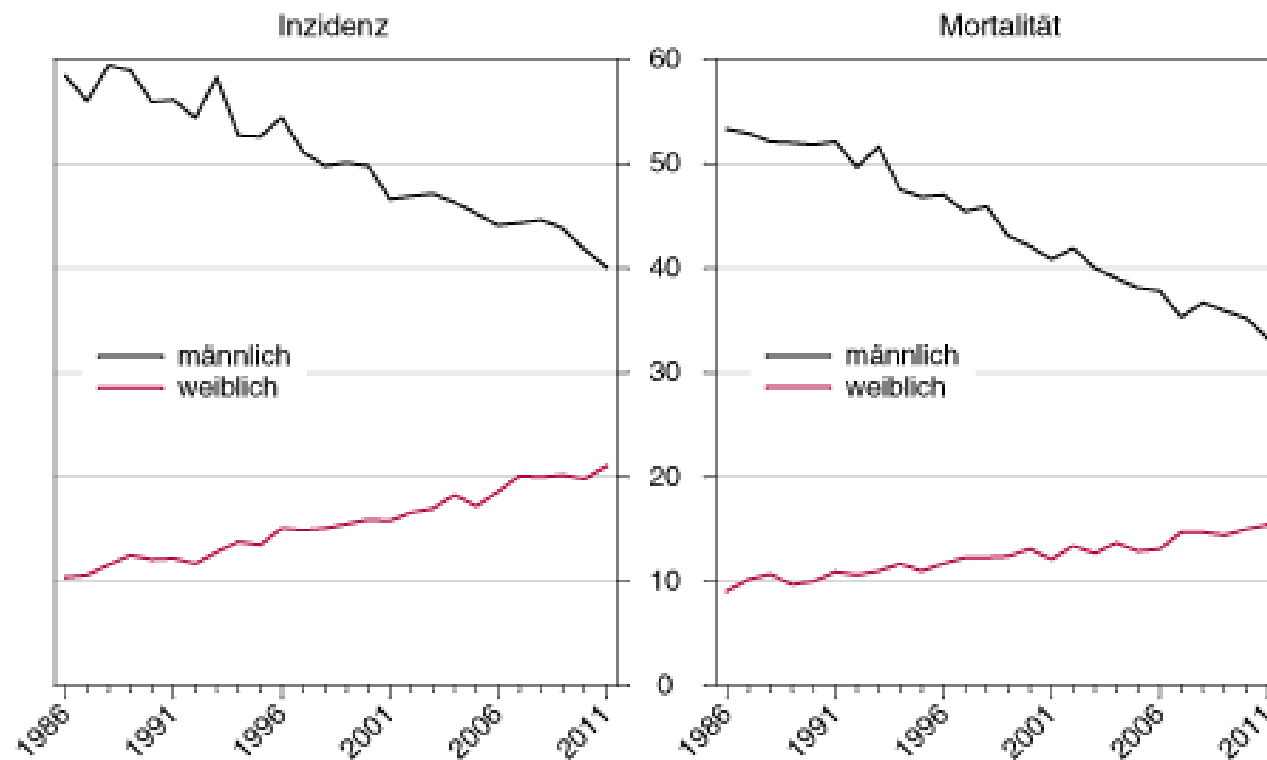
Q: STATISTIK AUSTRIA, Österreichisches Krebsregister (Stand 17.10.2013). Erstellt am 25.10.2013.

Bronchialkarzinom Epidemiologie

Bösartige Neubildungen der Lunge im Zeitverlauf

altersstandardisierte Raten auf 100.000 Personen

(WHO-Weltbevölkerung, 2001)

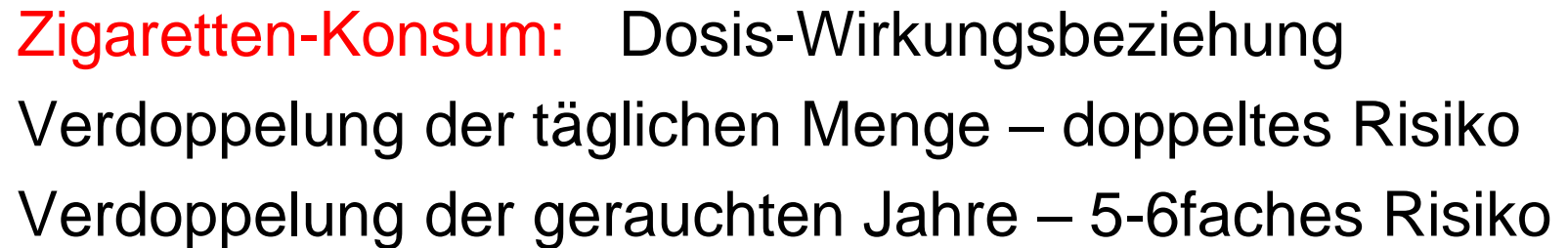


Q: STATISTIK AUSTRIA, Österreichisches Krebsregister (Stand 16.12.2014) und Todesursachenstatistik.
Erstellt am 12.01.2015.



Bronchuskarzinom Ätiologie

- Rauchen, auch Passivrauchen
- ionisierende Strahlen Feinstaub
- Dieselmotorabgase
- Asbest
- Quarzstäube
- berufliche Exposition nach deutscher Berufskrankheiten-Verordnung: Arsen, Beryllium, Cadmium, Chrom, Kokereirohgase, Nickel, polyzyklische aromatische Kohlenwasserstoffe (PAK), Siliziumdioxid



„Light-Zigarette“: i.a. keine Reduktion des Risikos, weil tiefere Inhalation

vermehrte Zigarettenmenge bei Nikotinabhängigkeit

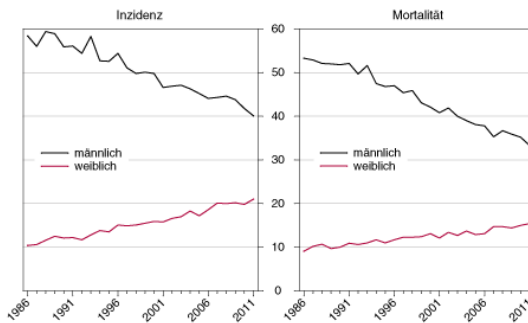
Je früher der Beginn des Rauchens, desto höher das Risiko (bis 30fach)

Passivrauchen! (privat – Arbeitsplatz)

Bronchialkarzinom Prävention

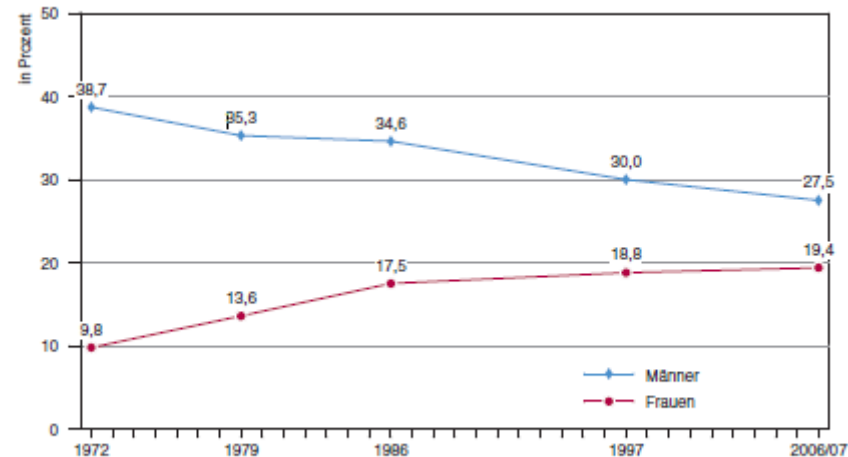
- Primärprävention („be smart – don't start!“)
- Aufhören mit Rauchen lohnt!
- Intensivierung der Raucherentwöhnung (Gruppendynamik)

Bösartige Neubildungen der Lunge im Zeitverlauf
altersstandardisierte Raten auf 100.000 Personen
(WHO-Weltbevölkerung, 2001)



Q: STATISTIK AUSTRIA, Österreichisches Krebsregister (Stand 16.12.2014) und Todesursachenstatistik.
Erstellt am 12.01.2015.

Grafik 18: Anteil der Raucherinnen und Raucher in der Bevölkerung ab 16 Jahren
Share of smokers in population aged 16 years or more



Q: STATISTIK AUSTRIA, Österreichische Gesundheitsbefragung 2006/2007.

international union
against cancer



Lung – 7th edition

includes non-small cell and small cell carcinoma & carcinoid

T1 ≤ 3 cm

T1a ≤ 2 cm

T1b $> 2 - 3$ cm

T2 Main bronchus ≥ 2 cm from carina, invades visceral pleura, partial atelectasis

T2a $> 3 - 5$ cm

T2b > 5 cm - 7 cm

T3 > 7 cm; chest wall, diaphragm, pericardium, mediastinal pleura, main bronchus < 2 cm from carina, total atelectasis, **separate nodule(s) in same lobe (was T4)**

T4 Mediastinum, heart, great vessels, carina, trachea, oesophagus, vertebra; **separate tumour nodule(s) in a different ipsilateral lobe (was M1)**

N1 Ipsilateral peribronchial, ipsilateral hilar

N2 Ipsilateral mediastinal, subcarinal

N3 Contralateral mediastinal or hilar, scalene or supraclavicular

M1a Separate tumour nodule(s) in a contralateral lobe; pleural nodules or **malignant pleural or pericardial effusion (was T4)**

M1b Distant metastasis

Changes from 6th edition

international union
against cancer



Lung – 7th edition

includes non-small cell and small cell carcinoma & carcinoid

| | | | |
|------------------|--------------|--------|--------|
| Occult carcinoma | TX | | |
| | N0 | | |
| Stage 0 | Tis | | |
| | N0 | | |
| Stage IA | T1a, b | | |
| | N0 | | |
| Stage IB | T2a | | |
| | N0 | | |
| Stage IIA | T2b | | |
| | N0 | T1a, b | |
| | N1 | | |
| | T2a | N1 | |
| Stage IIB | T2b | | |
| | N1 | | |
| | T3 | | |
| | N0 | | |
| Stage IIIA | T1a,b, T2a,b | | N2 |
| | T3 | | N1, N2 |
| | T4 | | N0, N1 |
| Stage IIIB | T4 | | N2 |
| | Any T | | N3 |
| Stage IV | Any T | Any N | M1 |

Changes to the 6th edition are based upon recommendations from the IASLC Lung Cancer Staging Project (retrospective study of 80,000 cases)

One classification for several tumor types; must separate tumors by histology.

Changes from 6th edition

INTERNATIONAL UNION AGAINST CANCER
www.uicc.org

UICC Altes (V6) und Neues (V7) Staging

| TNM-Staging im Vergleich | | | | | |
|--|----------------------|------|------|------|------|
| Altes Staging (1997) | Neues Staging (2009) | N0 | N1 | N2 | N3 |
| T1 (≤2cm) | T1a | IA | IIA | IIIA | IIIB |
| T1 (>2 und ≤3cm) | T1b | IA | IIA | IIIA | IIIB |
| T2 (>3 und ≤5cm) | T2a | IB | IIA | IIIA | IIIB |
| T2 (>5 und ≤7cm) | T2b | IIA | IIIB | IIIA | IIIB |
| T2 (>7cm) | T3 | IIIB | IIIA | IIIA | IIIB |
| T3 (mit Infiltration) | T3 | IIIB | IIIA | IIIA | IIIB |
| T4 (Knoten im gleichen Lappen) | T3 | IIIB | IIIA | IIIA | IIIB |
| T4 | T4 | IIIA | IIIA | IIIB | IIIB |
| M1 (anderer ipsilat. Lappen) | T4 | IIIA | IIIA | IIIB | IIIB |
| T4 (maligner Pleuraerguss) | M1a | IV | IV | IV | IV |
| M1 (kontralat. Lappen) | M1a | IV | IV | IV | IV |
| M1 (Fernmetastasen) | M1b | IV | IV | IV | IV |
| Fett gedruckte Zellen markieren Änderungen im neuen Stagingssystem | | | | | |
| Quelle: Goldstraw P et al. The IASLC Lung Cancer Staging Project: proposals for the revision of the TNM stage groupings in the forthcoming (seventh) edition of the TNM Classification of malignant tumours. J Thorac Oncol 2007; 2: 706-714 | | | | | |

Tab: Vergleich altes und neues TNM-Stagingssystem

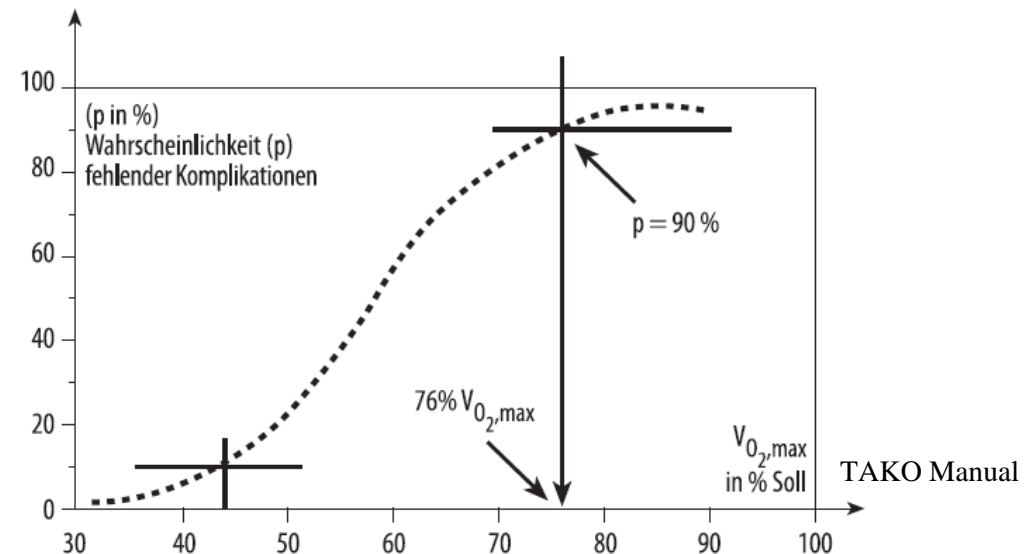
Diagnostik



- Anamnese (Risikofaktoren, Co-Morbiditäten)
- Lungenröntgen
- CT (mit OB-Organen – NN!!)
- Bronchoskopie
- Biopsie – FNP nicht empfohlen
- Spirometrie
- Lymphknoten Staging
- EBUS, PET-CT, Mediastinoskopie

Funktionsanalytik

- FEV1 % (Sekundenkapazität)
- DLCO % Lungendiffusion
- VO2max % Max. Sauerstoffaufnahme



- FEV1 <80% - DLCO <40% ➔ Funktionell inoperabel



- **Crux in Therapieplanung Stadium III**
- Heterogene Gruppe
- Multimodale Therapie
- Wann wird es definiert?
- Interdisziplinäres pulmonologisches Tumorboard!



Chirurgische Verfahren

- Anästhesie seitenge trennte Beatmung ggf. PDK
- **Segmentresektion** z.B. bei kleinem Tumor/eingeschränkter LF
- Extraanatomische Lungenteilresektion (atypisch) = Keilresektion
- **Lobektomie** (Standardverfahren)
- **Manschettenresektion**
(bronchoplastische/bronchoangioplastische Verfahren)
- **Pneumektomie**
- **Erweiterte Resektion** Entfernung von Teilen des Perikardes, Pleura, Brustwand, Diaphragma
- **Lymphknotenresektion**

Morbidität



- Bronchusstumpf - Insuffizienzrate knapp $> 1\%$
- Pneumonektomie 2,4% -> Deckung .
- Risikoerhöhung der postop. M & M
 - COPD
 - Kardiovaskuläre Erkrankungen
 - Pulmonalembolie

Letalität

- Letalität nach Lungenresektionen global zwischen 3% und 5%
- Pneumonektomie 5-8%
- Lobektomie 1,4% - 2,7%
- >> höheres Alter, Begleiterkrankungen, neoadjuvante Therapie

5-Jahres-Überlebensraten

Patienten mit nicht-kleinzelligem Bronchialkarzinom

| ISS-Stadium TNM | | | | 5-Jahres-Überlebensrate | |
|-----------------|------|------|----|-------------------------|------------------------|
| | | | | Klinisches | Chirurgisches* Staging |
| Stadium IA | T1 | N0 | M0 | 61% | 67% |
| | IB | T2 | N0 | 38% | 57% |
| Stadium IIA | T1 | N1 | M0 | 34% | 55% |
| | IIB | T2 | N1 | 24% | 39% |
| | T3 | N0 | M0 | 22% | 38% |
| Stadium IIIA | T3 | N1 | M0 | 9% | 25% |
| | T1-3 | N2 | M0 | 13% | 23% |
| Stadium IIIB | T4 | N0-2 | M0 | 7% | - |
| | T1-4 | N3 | M0 | 3% | - |
| Stadium IV | T1-4 | N0-3 | M1 | 1% | - |

* Überlebensraten nach operativer Behandlung mit chirurgischer Verifikation des Stadiums und histomorphologischer Bestätigung

Lungenkarzinom (Lungenkrebszentren)

Indikatoren der Prozessqualität der chirurgischen Therapie

| Zähler | Nenner | Referenzbereich |
|---|----------------------------------|------------------------|
| Pneumektomien | Lungenresektionen | $\leq 25\%$ |
| Broncho-/angio-plastische Operationen | Lungenresektionen | $\geq 10\%$ |
| Postoperative Wundinfektionen | Lungenresektionen | $< 2\%$ |
| Bronchusstumpf-/Anastomoseninsuffizienz | Lungenresektionen mit Anastomose | $\leq 10\%$ |
| Revisionsoperationen | Lungenresektionen | $< 10\%$ |
| 30-Tage-Mortalität | Lungenresektionen | $< 5\%$ |

Mainz JJ et al.: National Quality Measurement Using Clinical Indicators: The Danish National Indicator Project; J. Surg. Oncol. 2009;99:500–504

Lungenkarzinom

Indikatoren der Prozessqualität der chirurgischen Therapie

| Zähler | Nenner | Referenzbereich |
|--------------------|-------------------|-----------------|
| 30-Tage-Mortalität | Lungenresektionen | <5% |

Externes Qualitätsmanagement:

Nationales Benchmarking-Programm Nordeuropäischer Länder

| Indikator | Benchmark | Dänemark | Finnland | Grönland | Island |
|--|-----------|----------|----------|----------|--------|
| 30-Tage-Mortalität/ Lungenresektionen 2005 | <5% | 3,2% | 3,8% | 17,8% | 1,1% |



Zentrumsbildung ?



Table 1. Comparison of Patient, Tumor, and Treatment Factors at Highest-Compared With Lowest-Volume Hospitals

| Factor | Highest Volume | Lowest Volume* |
|--|----------------|----------------|
| Lung | | |
| Total No. of patients | 40,754 | |
| Total No. of hospitals | 1,528 | |
| No. of hospitals in highest and lowest quintiles | 68 | 837 |
| Median age, years | 67 | 67 |
| Interquartile range | 59-73 | 59-73 |
| % of patients | | |
| Stage I | 58.2 | 59.0 |
| Stage II | 21.9 | 22.6 |
| Stage III | 19.8 | 18.4 |
| Adjuvant chemotherapy | 15.9 | 17.0 |
| Adjuvant radiation | 18.1 | 24.3 |
| Volume threshold | > 83 | < 21 |

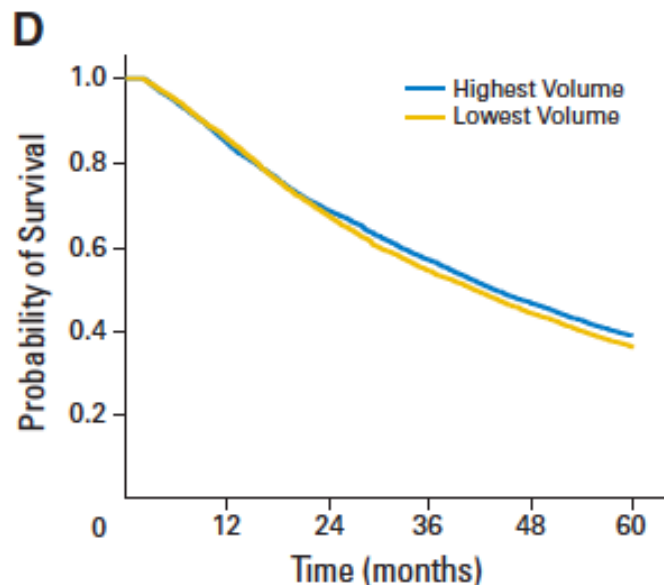


Table 2. Unadjusted Perioperative Mortality, 5-Year Overall Survival, and 5-Year Conditional Survival Comparing Highest-, Moderate-, and Lowest-Volume Hospitals

| Cancer Type | % | | | | | | | | |
|-------------|-------------------------|-----------------|---------------|-------------------------|-----------------|---------------|------------------------------|-----------------|---------------|
| | Perioperative Mortality | | | 5-Year Overall Survival | | | 5-Year Conditional Survival* | | |
| | Highest Volume | Moderate Volume | Lowest Volume | Highest Volume | Moderate Volume | Lowest Volume | Highest Volume | Moderate Volume | Lowest Volume |
| Colon | 5.0 | 5.7† | 5.9† | 52.5 | 51.2 | 49.9† | 55.3 | 54.4 | 53.2† |
| Esophagus | 6.1 | 10.7† | 10.9† | 30.4 | 21.3† | 20.7† | 32.4 | 23.9 | 23.3† |
| Liver | 6.2 | 10.7† | 11.9† | 39.0 | 31.3† | 34.8† | 41.6 | 35.0† | 39.5† |
| Lung | 5.5 | 6.1† | 6.4† | 36.0 | 34.8† | 32.7† | 38.1 | 37.1 | 35.0† |
| Pancreas | 4.9 | 9.3† | 10.5† | 15.4 | 11.8† | 12.5† | 16.2 | 13.1† | 14.0† |
| Rectal | 1.9 | 2.6† | 3.0† | 60.7 | 56.5† | 53.4† | 61.9 | 58.1† | 55.1† |
| Stomach | 5.7 | 8.8† | 8.9† | 30.0 | 28.9 | 26.7† | 37.0 | 31.7† | 29.3† |

NOTE. The moderate-volume category includes the second, third, and fourth quintiles. Median follow-up: colon, 41 months; esophagus, 16 months; liver, 25 months; lung, 29 months; pancreas, 14 months; rectal, 54 months; stomach, 20 months.

*5-year survival for patients surviving the perioperative period (excludes perioperative deaths).

†P < .05.



“In conclusion, our results indicate that hospitals in England with high volumes of surgical resection of lung cancer perform surgery among patients who are older, are more socioeconomically deprived, and have more comorbidity. Despite this, they achieve better survival, especially in the early postoperative period.”

Lüchtenborg M. et al.: J Clin Oncol 31:3141-3146; 2013



Leitlinien



Prevention, Diagnosis, Therapy, and Follow-up of Lung Cancer

Interdisciplinary Guideline of the German Respiratory Society and the German Cancer Society*

Bibliography

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with the cooperation of the

- ▶ German Society of Occupational and Environmental Medicine,
- ▶ German Society for Epidemiology,
- ▶ German Society of Haematology and Oncology,
- ▶ German Society for Medical Informatics, Biometrics and Epidemiology,
- ▶ German Society of Nuclear Medicine,
- ▶ German Society for Palliative Care,
- ▶ German Society of Pathology,
- ▶ German Society of Radiation Oncology,
- ▶ German Society for Thoracic Surgery,
- ▶ German Radiologic Society,
- ▶ Austrian Society for Haematology and Oncology,
- ▶ Austrian Society of Pneumology,
- ▶ Austrian Society for Radiation Oncology, Radiobiology and Medical Radiophysics

Pneumologie 2011; 65: 39–59



Austrian Society
of Surgical Oncology

Manual der Chirurgischen Krebstherapie

Herausgegeben von der
Österreichischen Gesellschaft für Chirurgische Onkologie
Austrian Society of Surgical Oncology

Kauer & Pacherer, GmbH
VERLAG für MEDIZIN und WIRTSCHAFT

ACO-ASSO Manual der Chirurgischen Krebstherapie



Lungenkarzinom

Empfehlungen zu Diagnostik, Therapie und
Nachsorgeuntersuchungen in Tirol





Chirurgische Standards

- Stadium I, II,
kurative Resektion (Lobektomie) mit
systematischer ipsilateraler
Lymphadenektomie



Sonderfälle



- Limitierte Resektionen
- Broncho- u/o angioplastische Operationen
- VATS

Limitierte Resektionen

- Multizentrisch, prospektiv randomisiert
- 276/247 Patienten (T1 N0)
- Keine Vorteile: postop. Morbidität, Letalität, Spätfunktion Lunge
- Aber:/.

Ginsberg R. J., Rubinstein L. V.: Randomized trial of lobectomy versus limited resection for T1 N0 non-small cell lung cancer. Lung Cancer Study Group. Ann Thorac Surg 60: **615-622** (1995)

Limitierte Resektionen

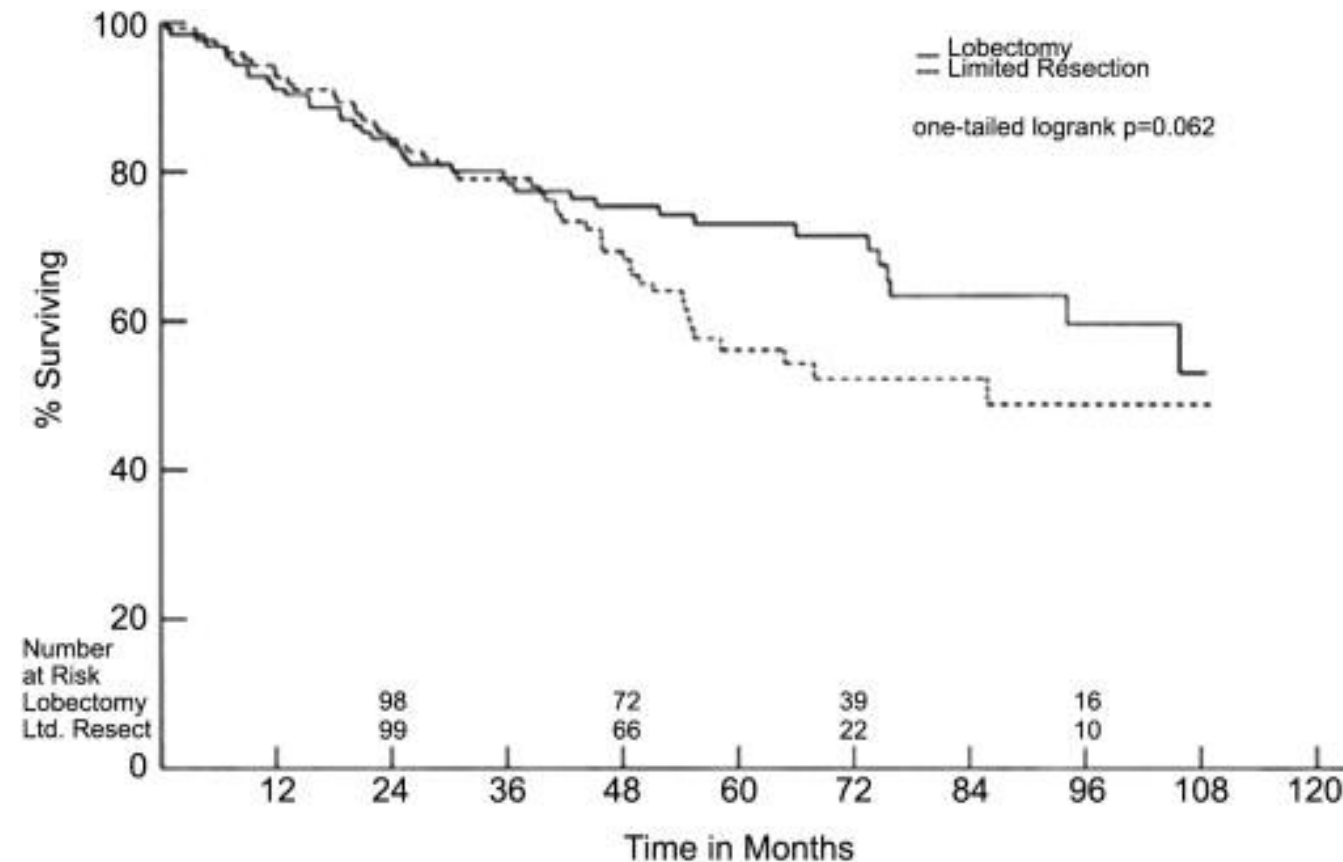


Table 3. Recurrence and Death Rates for the 247 Eligible Patients on LCSG 821^a

| Event | Limited Resection | | Lobectomy | | p Value |
|---------------------------------------|-------------------|---------------------|-----------------|---------------------|-------------------------|
| | No. of Patients | Rate (per person/y) | No. of Patients | Rate (per person/y) | |
| Recurrence (excluding second primary) | 38 | 0.101 | 23 | 0.057 | 0.02 ^b |
| Recurrence (including second primary) | 42 | 0.112 | 32 | 0.079 | 0.079 ^b |
| Locoregional recurrence ^d | 21 | 0.060 | 8 | 0.020 | 0.008 ^c |
| Nonlocal recurrence ^d | 17 | 0.048 | 15 | 0.037 | 0.672 (NS) ^c |
| Death (with cancer) | 30 | 0.073 | 21 | 0.049 | 0.094 ^b |
| Death (all causes) | 48 | 0.117 | 38 | 0.089 | 0.088 ^b |

^a Note locoregional recurrence rates and death rates are significantly increased after limited resection. ^b One-sided (refer to text); ^c two-sided (refer to text); ^d for definition of recurrences, refer to text.

NS = not significant.

Ginsberg R. J., Rubinstein L. V.: Randomized trial of lobectomy versus limited resection for T1 N0 non-small cell lung cancer. Lung Cancer Study Group. Ann Thorac Surg 60: 615-622 (1995)



Sonderfälle

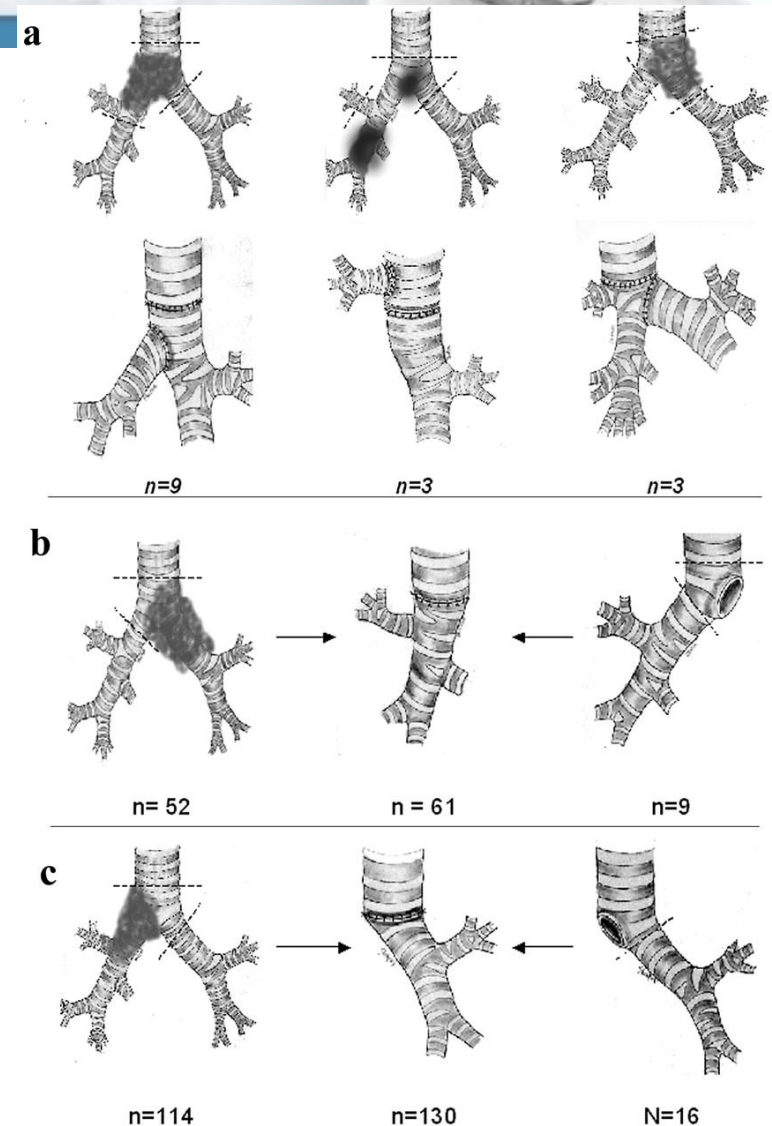


- Limitierte Resektionen
- Broncho- u/o angioplastische Operationen
- VATS

Different types of carinal resections



- (a) the complex reconstruction' type of resections includes carina resection, preservation of intact lung, and formation of second anastomosis end-to-side';
- (b) (b,c) sleeve resection of bifurcation with pneumonectomy or following pneumonectomy (for primary tumor or recurrence, main bronchus short stump fistula)



Porhanov V. A. et al.; Eur J Cardiothorac Surg 2002;22:685-694

Sleeve Resection

- Parenchymsparende Alternative zur Pneumektomie

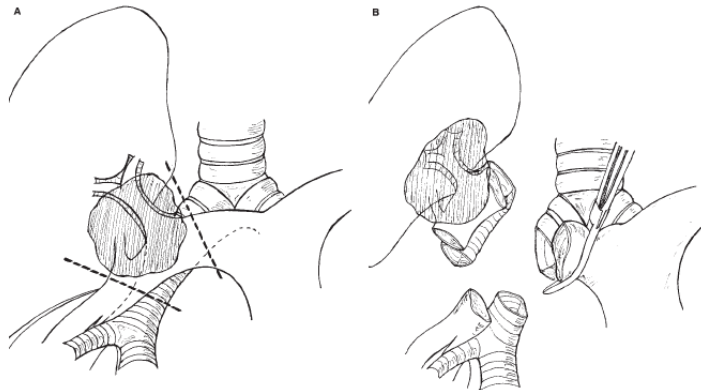
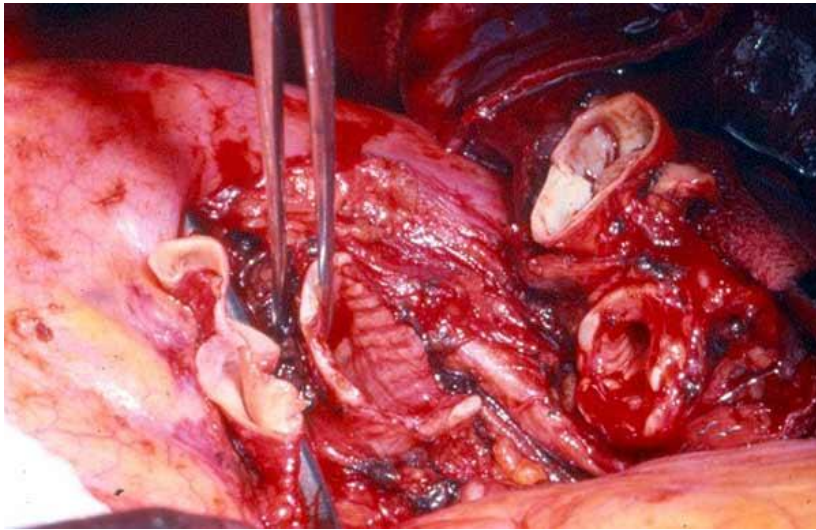
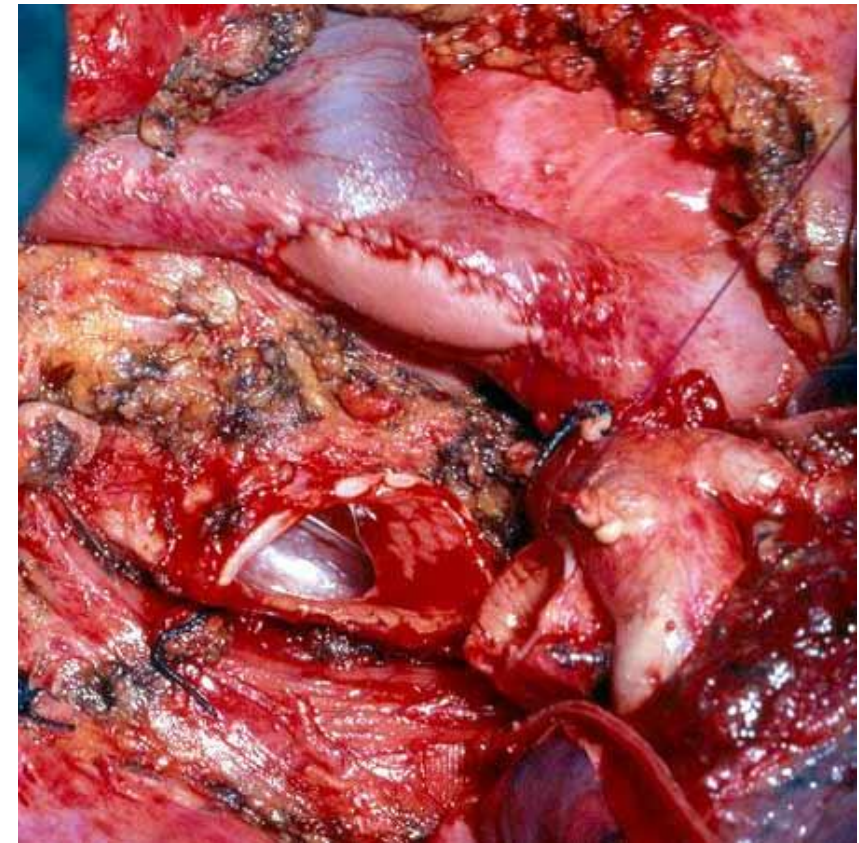


Fig. 2. Double sleeve resection of the bronchus and pulmonary artery (PA): A) the tumor infiltrates the origin of the upper lobe bronchus and most of the circumference of the PA; B) proximal and distal transection of the bronchus and PA.



Sleeve Resection



- Metaanalyse 860 Sleeves / 746 Pneumektomien
- 12 Artikel
- Dominanz St II bei Pneumekt.
- Lokalrezidiv Wahrscheinlichkeit höher bei Sleeve

F. C. Detterbeck. General aspects of surgical treatment. In: Diagnosis and treatment of lung cancer : an evidence-based guide for the practicing clinician (Eds. Detterbeck FC, Rivera MP, Socinski MA, Roseman JG). , 133-147. 2001n

Ferguson M.K, et.al.: Sleeve lobectomy or pneumonectomy: optimal management strategy using decision analysis techniques. Ann Thorac Surg 76: 1782-1788 (2003)

Table 2. Probabilities of Events and Utilities of Health States

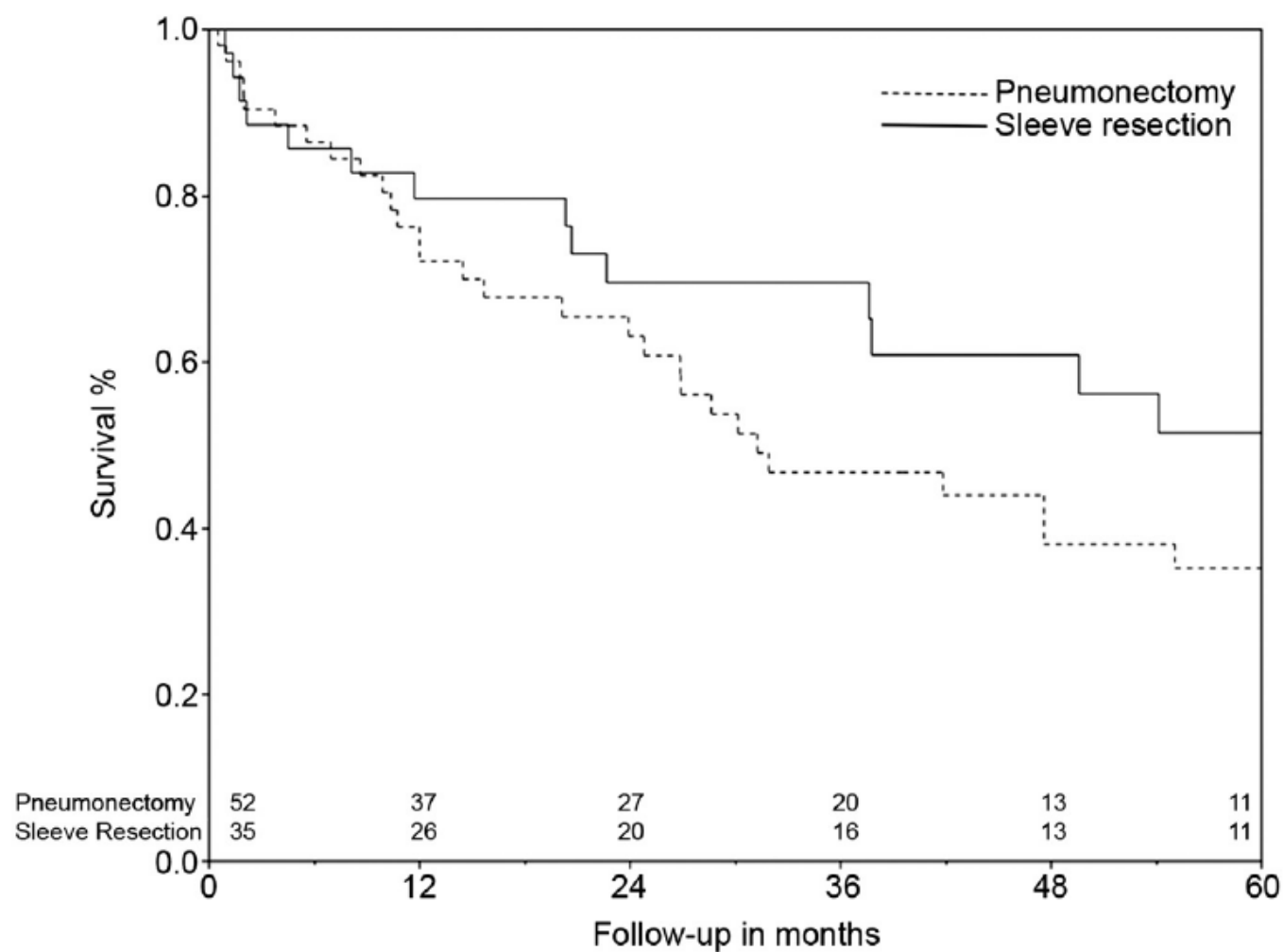
| Event/Utility | Value | Range | Source References |
|--|--------|---------------|-------------------|
| Sleeve lobectomy | | | |
| Operative mortality | 0.04 | 0.02–0.06 | 8–18 |
| Risk of local/regional recurrence | 0.2 | 0.1–0.3 | 9,11,13 |
| Risk of other recurrence | 0.21 | 0.1–0.3 | 9,11,13 |
| 5 year survival (%): no recurrence | 0.77 | 0.6–0.9 | 8–18 |
| Median survival (years): no recurrence | 8.8 | 7–10 | 8–18 |
| QOL: no recurrent cancer | 0.8 | 0.6–1.0 | 32–36 |
| QOL: recurrent cancer | 0.5 | 0.3–0.7 | 33 |
| Cost of resection (\$) | 14,925 | 13,837–15,540 | Study data |
| Pneumonectomy | | | |
| Operative mortality | 0.06 | 0.01–0.11 | 11,15,18–21 |
| Risk of local/regional recurrence | 0.1 | 0.05–0.15 | 18 |
| Risk of other recurrence | 0.21 | 0.1–0.3 | 18 |
| 5 year survival (%): no recurrence | 0.64 | 0.5–0.8 | 11,15,17–21 |
| Median survival (years): no recurrence | 6.1 | 4.5–7.5 | 11, 18–21 |
| QOL: no recurrent cancer | 0.7 | 0.5–0.9 | 32–36 |
| QOL: recurrent cancer | 0.45 | 0.25–0.65 | 33 |
| Cost of resection (\$) | 13,503 | 12,519–14,060 | Study data |



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SLEEVE LOBECTOMY FOR N1 LUNG CANCER

Ann Thorac Surg
2014;97:230-5

Fig 1. Survival stratified by extent of resection.





Sonderfälle



- Limitierte Resektionen
- Broncho- u/o angioplastische Operationen
- VATS

VATS

- 1281 Pat. Matched (STS Databasis)
- Results: Matching based on propensity 1281 Patienten / Gruppe ->postoperatives Ergebnis

VATS

Thorakotomie

- | | | |
|---------------------|------------------|------------------------------|
| • Ohne Kompl. | 945 (73.8%) | 847 (65.3%) (P<.0001) |
| • Arrhythmie | [n 1/4 93 (7.3%) | 147 (11.5%); P 1/4.0004], |
| • Reintubation | [n 1/4 18 (1.4%) | 40 (3.1%); P 1/4 .0046], |
| • Blutverbrauch | [n 1/4 31 (2.4%) | 1/4 60 (4.7%); P 1/4 .0028], |
| • Spitalsaufenthalt | 4.0 | 6.0 days; P<.0001 |
| • Beatmung | 3.0 | 4.0 days; P<.0001 |
- There was no difference in **operative mortality** between the 2 groups
 - Bislang keine randomisierte Studie

VATS

39 Studien

Table 1. Continued

| Lead Author | Year Published | Patients, No. | Age, y ^a | Gender, % | | Adenocarcinoma, % ^a | Squamous Cell Carcinoma, % ^a |
|-------------------|----------------|---------------|-------------------------|-------------------|-------------------|--------------------------------|---|
| | | | | F | M | | |
| Thoracotomy | | 3256 | 65.3 ± 2.5 | 40.8 | 59.2 | 59.1 ± 5.7 | 28.8 ± 3.5 |
| VATS ^a | | 3114 | 66.5 ± 1.7 ^b | 45.5 ^b | 54.7 ^b | 60.4 ± 3.6 ^b | 20.9 ± 2.6 ^c |

^a Results are reported as mean ± standard error. from thoracotomy.

^b Denotes not significantly different from thoracotomy.

^c Denotes significantly different ($p < 0.05$)

VATS = video-assisted thoracoscopic surgery.

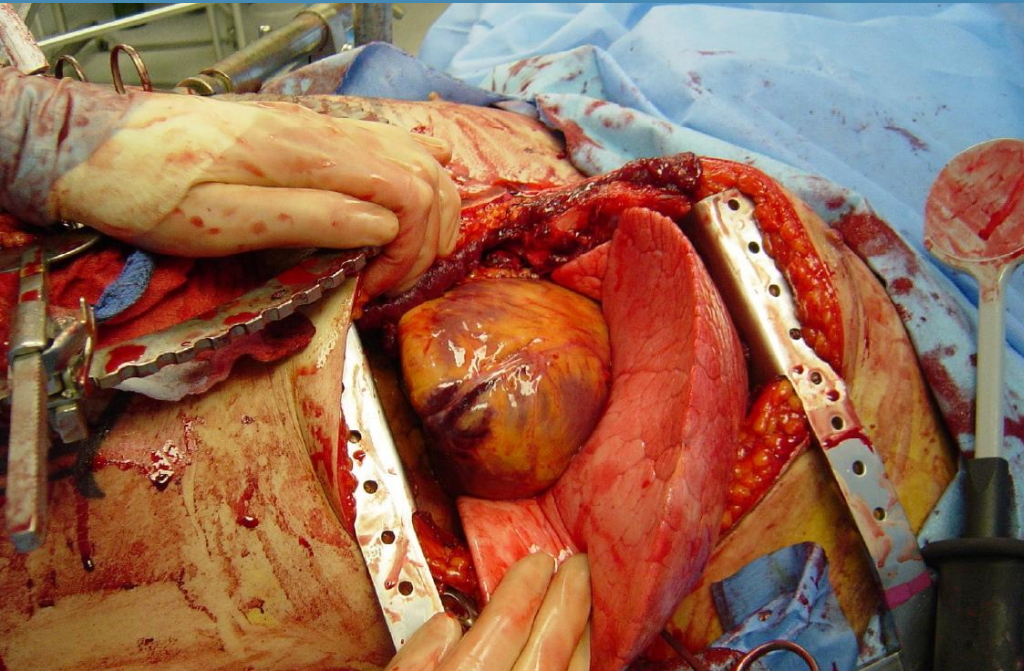
Table 3. Univariate Comparison of Surgical Approach to Lobectomy

| Variable | VATS | | | Thoracotomy | | | p Value |
|--------------------------|--------------|---------------|-------------------|--------------|---------------|------------------|---------|
| | Studies, No. | Patients, No. | Mean (95% CI) | Studies, No. | Patients, No. | Mean (95% CI) | |
| Overall survival, % | | | | | | | |
| 1-year | 9 | 867 | 98.2 (91.6–100.0) | 10 | 914 | 93.2 (86.9–99.4) | 0.28 |
| 2 year | 11 | 1486 | 91.6 (86.7–96.5) | 8 | 658 | 84.9 (77.8–91.9) | 0.12 |
| 3-year | 13 | 1623 | 87.2 (82.0–92.3) | 12 | 1223 | 81.6 (75.4–87.8) | 0.18 |
| 4-year | 8 | 759 | 88.4 (81.7–95.1) | 10 | 981 | 71.4 (62.4–80.3) | 0.003 |
| 5-year | 5 | 531 | 80.1 (67.5–92.7) | 16 | 1975 | 65.6 (56.7–74.4) | 0.064 |
| Overall complications, % | 11 | 2149 | 16.4 (12.2–20.6) | 9 | 979 | 31.2 (19.7–42.8) | 0.018 |
| Atrial fibrillation, % | 7 | 1095 | 5.2 (2.0–8.4) | 4 | 294 | 9.0 (2.1–15.8) | 0.33 |
| Pneumonia, % | 7 | 1095 | 2.7 (0.9–4.6) | 3 | 245 | 6.0 (0.0–13.2) | 0.40 |
| Persistent air leak, % | 8 | 1120 | 5.0 (3.3–6.8) | 5 | 325 | 8.8 (2.4–15.2) | 0.27 |
| Chest tube duration, d | 9 | 713 | 4.2 (3.2–5.3) | 7 | 355 | 5.7 (4.9–6.5) | 0.025 |
| Length of stay, d | 14 | 2218 | 8.3 (6.9–9.8) | 12 | 856 | 13.3 (9.5–17.1) | 0.016 |

CI = confidence interval; VATS = video-assisted thoracoscopic surgery.



So oder so?



VATS

- Video assisted thoracoscopic surgery
= Minimal invasive Chirurgie im Brustkorb
= „Schlüssellochchirurgie“



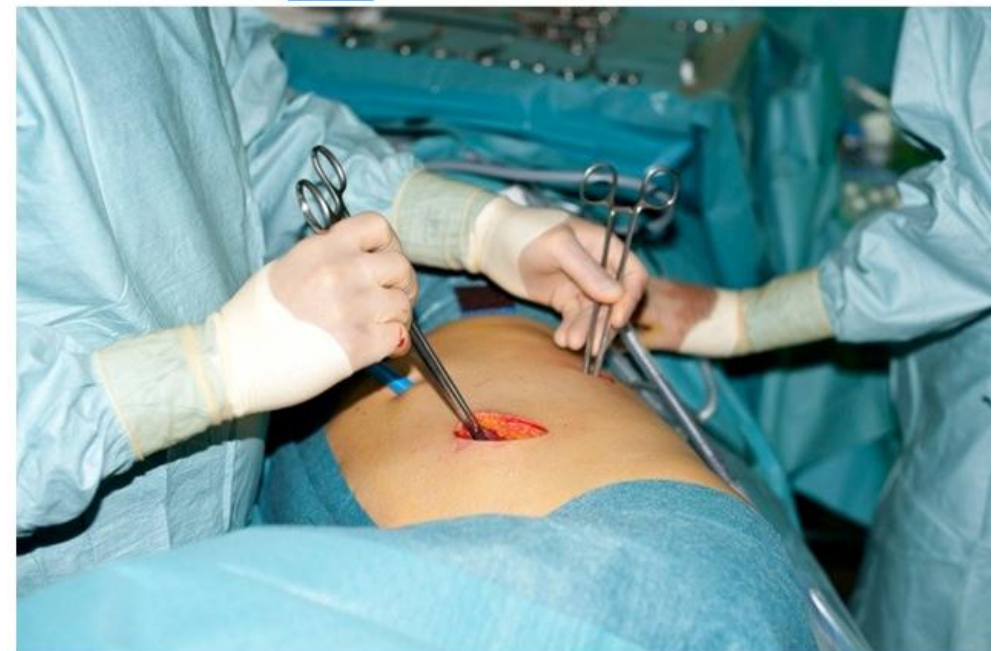
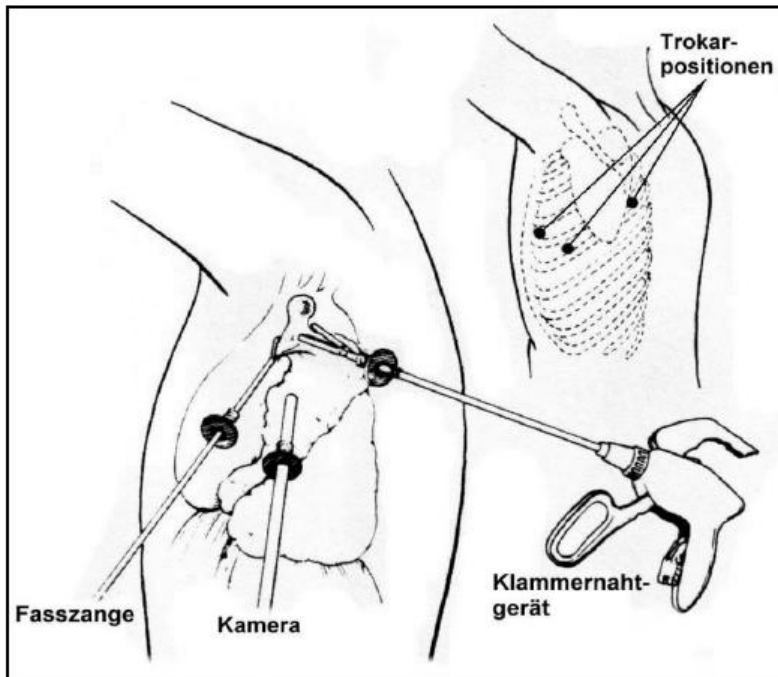
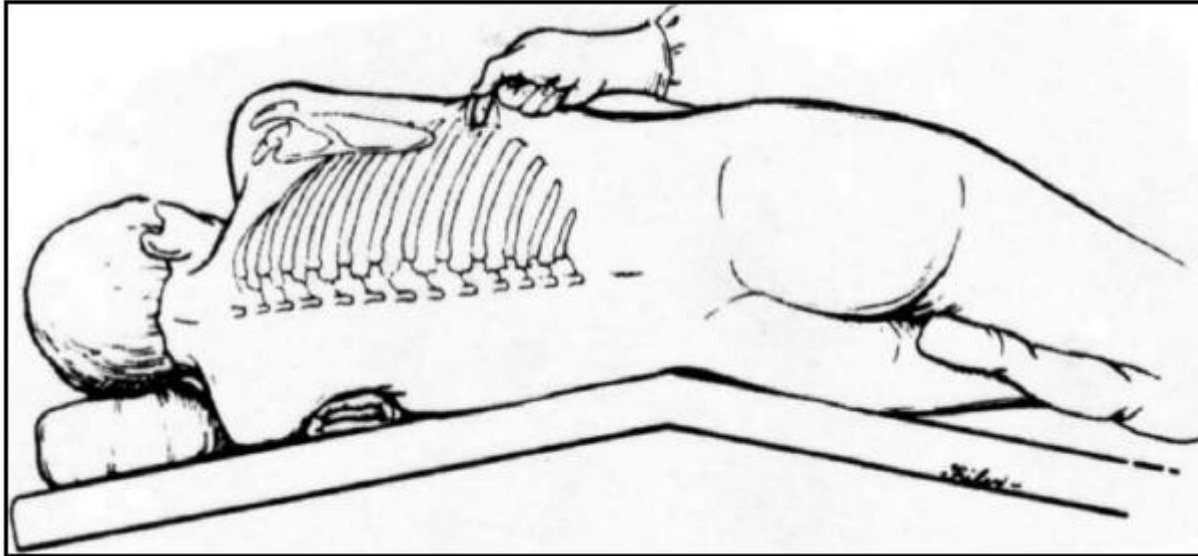
Grundvoraussetzungen für VATS

- Equipment (Instrumente, Klammernahtgeräte, HD-Kameras+Bildschirme)
- Einseiten-Lungenbeatmung mit Beatmungsstillstand auf der Operationsseite
- Erfahrenes, eingespieltes Team



VATS





René Petersen at Rigshospitalet, Copenhagen, Denmark





Funktion Klammernahtgerät

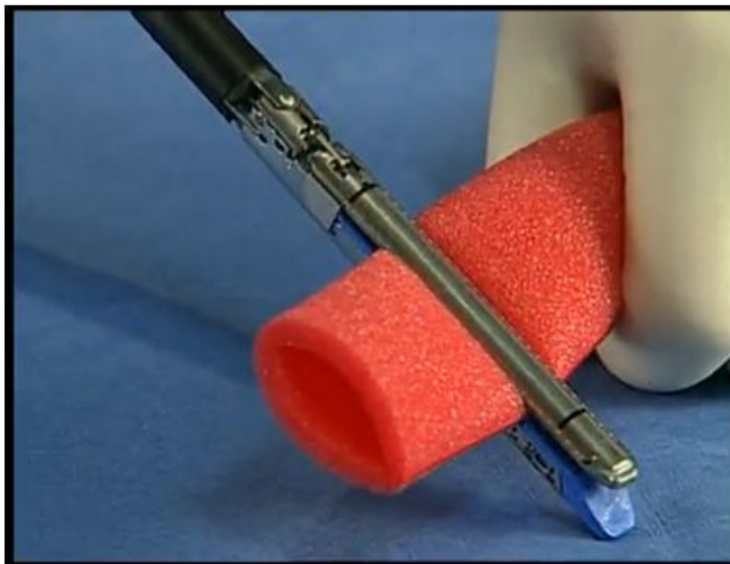
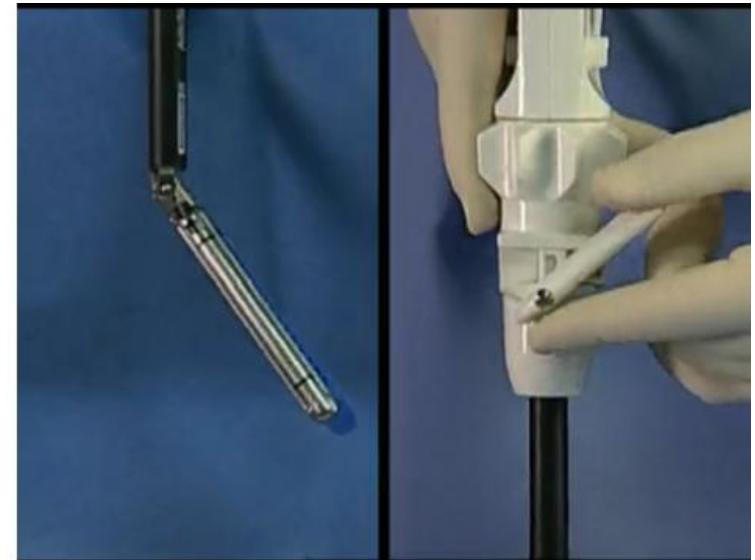
Available In 30mm, 45mm And
60mm Lengths



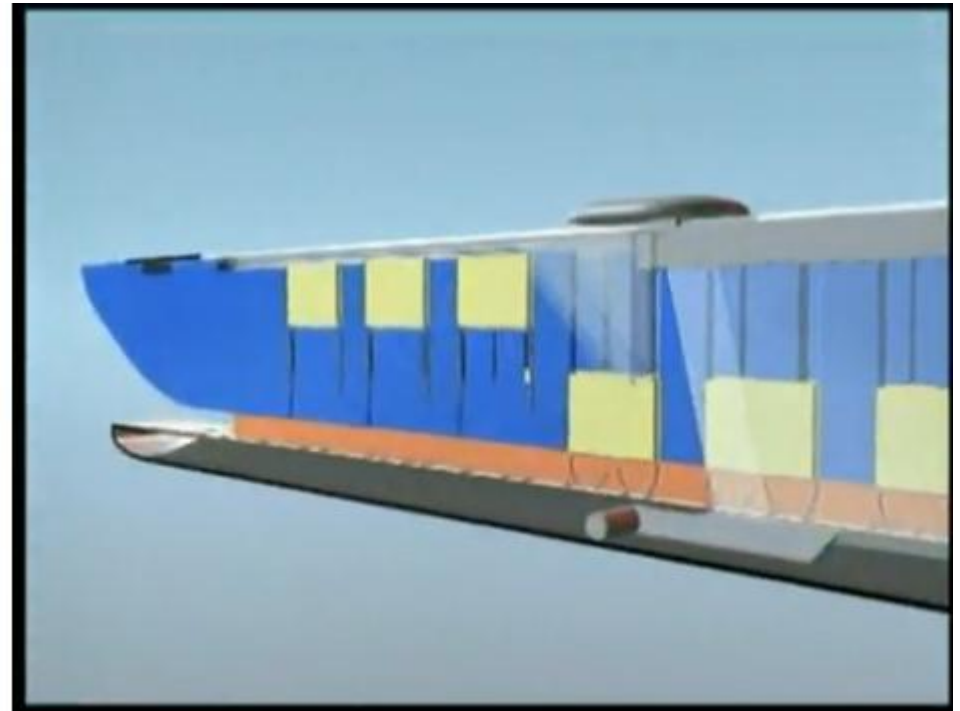
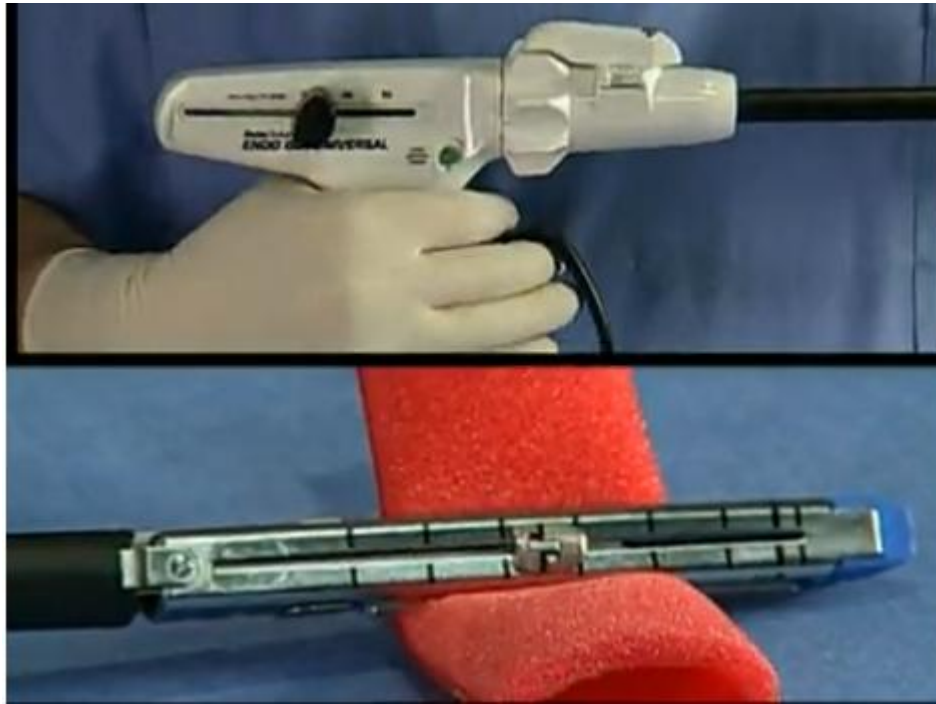
Straight



Roticulator™



Steps To Use





Warum VATS?



- Weniger Operationsbelastung
- Weniger Schmerzen
- Raschere Erholung
- Kürzere Rekonvaleszenz
- Frühere Wiederaufnahme der täglichen Aktivitäten
- Kürzere Spitalsliegedauer

Warum VATS?



Table 1 Summary of perioperative outcomes of unmatched and propensity score-matched patients who underwent video-assisted thoracic surgery (VATS) versus open thoracotomy for non-small cell lung cancer in three selected studies

| Measured outcome | Unmatched patients | | Matched patients | |
|--|--------------------|--------------|------------------|--------------|
| | VATS n=2,094 | Open n=5,636 | VATS n=1,681 | Open n=1,681 |
| Perioperative mortality | VATS < Open | | NS | |
| Perioperative morbidity | VATS < Open | | VATS < Open | |
| Prolonged air leak | VATS < Open | | NS | |
| Pneumonia | VATS < Open | | VATS < Open | |
| Pulmonary embolism | NS | | NS | |
| Atrial arrhythmias | VATS < Open | | VATS < Open | |
| Bleeding | NS | | NS | |
| Empyema | NS | | NS | |
| Sepsis | VATS < Open | | NS | |
| Length of stay | VATS < Open | | VATS < Open | |
| '<' indicates statistically lower rate or duration according to meta-analysis; NS, not significant | | | | |

Cao et al., Ann Cardiothorac Surg 1: 16 - 23 (2012)

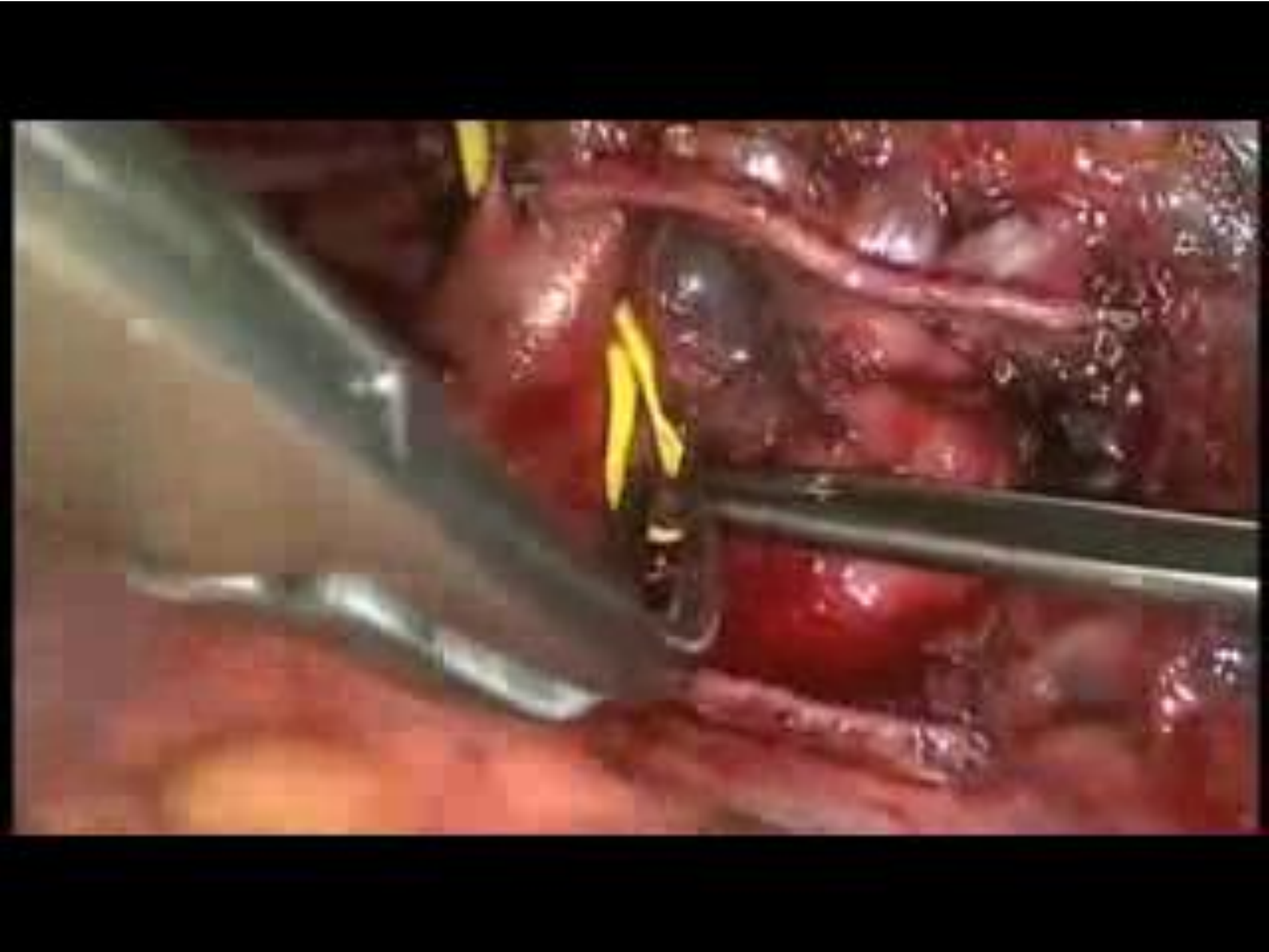
- In Hinblick auf Prognose bei Lungenkrebs der offenen Chirurgie mindestens ebenbürtig!

Yan et al., J Clin Oncol 27: 2553-62 (2009)

Aber

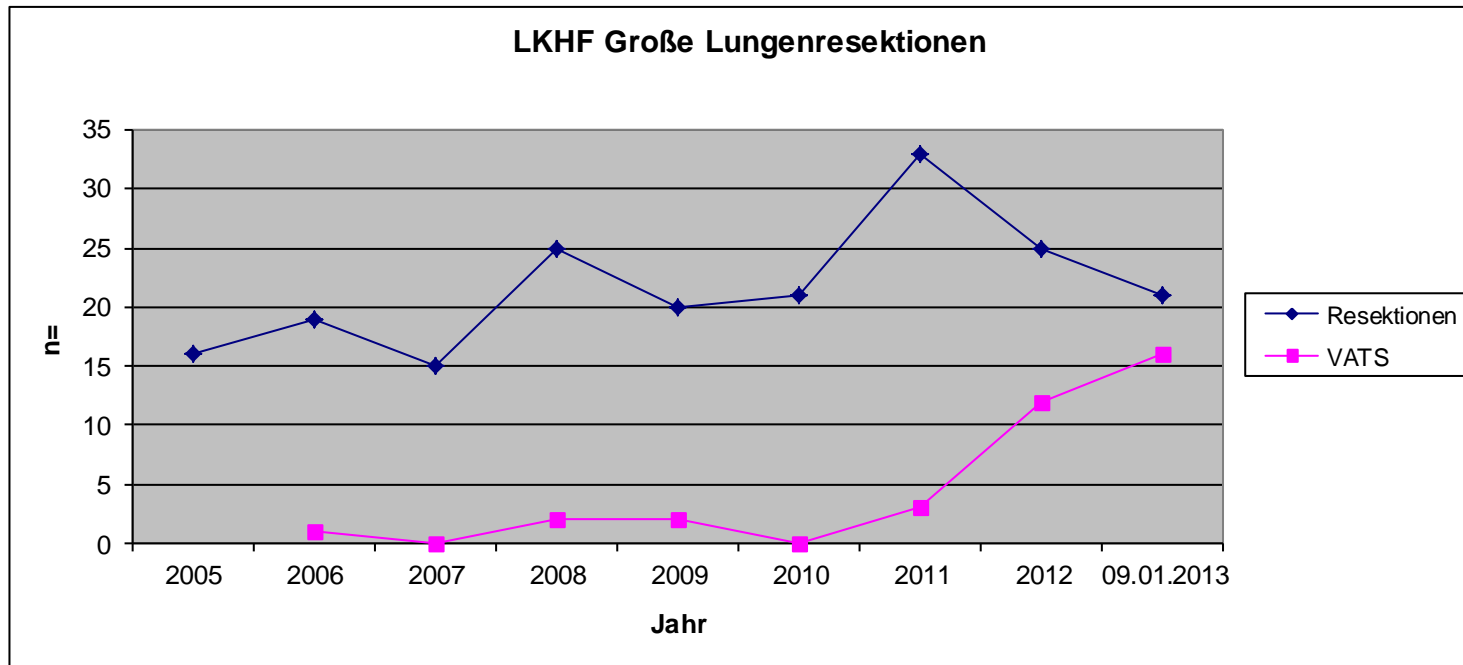
- Operativ-technisch anspruchsvoll
- Neu- und Umlernen erforderlich
- Lernkurve
- Teamgeist der Op-Mannschaft
- Anforderungen an Instrumente und sonstige technische Hilfsmittel
Klammernahtgeräte,
Instrumentendesign,
Video-technische Anlagen
- Patientenetauswahl











VATS:

Umstieg auf offene Technik n=4

Letalität n=0

Lymphadenektomie



- Metaanalyse, 17 Publikationen (11 RCT) Chir/n-chir Th.;
differente chir. Therapien
- 3 Studien systematische Lymphadenektomie vs.
Sampling – gepoolte Daten (n=848)

| | | | | | |
|--|---|--|---|-----|--|
| University of Munich and Central Hospital, Gauting, Germany (1989–91) ¹³ Izbicki | Resectable NSCLC (stages I–IIIA) | Thoracotomy, surgical resection, complete mediastinal lymph node dissection | Thoracotomy, surgical resection, systematic sampling of mediastinal lymph nodes | 201 | Overall and progression free survival (median follow up 47 months) |
| Yamaguchi University, Japan (1985–92) ¹⁴ Sugi | Peripheral NSCLC <2 cm diameter, mediastinal and hilar lymph nodes <1 cm on CT (no mediastinoscopy) | Thoracotomy, surgical resection, complete mediastinal lymph node dissection | Thoracotomy, surgical resection, systematic sampling of mediastinal lymph nodes | 115 | Overall 5 year survival |
| Sun Yat-Sen University of Medical Sciences, Guangzhou, China (1989–95) ¹⁵ Wu | Pathologically confirmed NSCLC, clinical stages I–IIIA, age <71 years | Thoracotomy, surgical resection, complete mediastinal lymph node dissection | Thoracotomy, surgical resection, systematic sampling of mediastinal lymph nodes | 532 | Overall 5 year survival |

Wright G., Manser R. L., Byrnes G. et al.: Surgery for non-small cell lung cancer: systematic review and meta-analysis of randomised controlled trials. Thorax 61: 597-603 (2006)

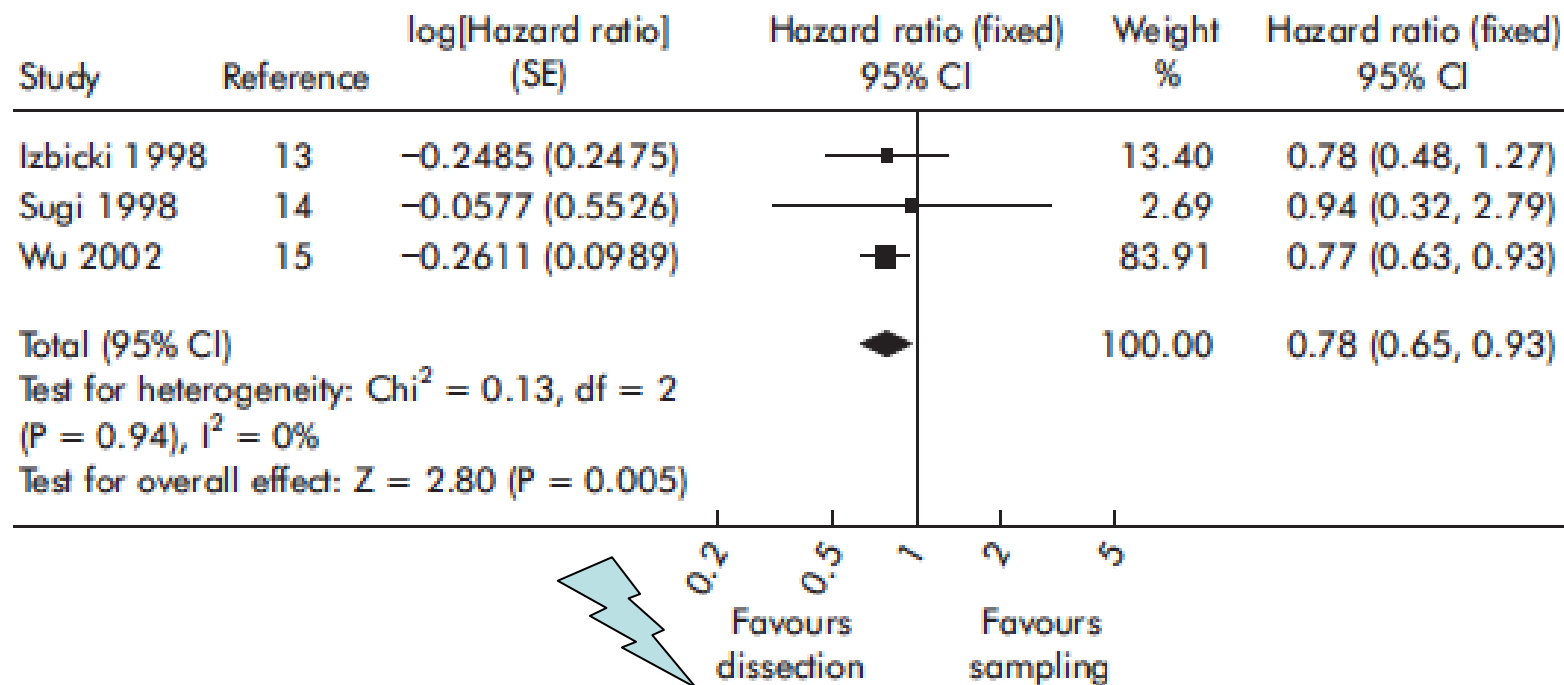


Figure 3 Hazard ratio (4 year survival) for studies comparing complete mediastinal lymph node dissection with mediastinal node sampling. For the individual trials the squares represent the hazard ratios and the line represents the 95% confidence intervals. The diamond represents the results of the pooled analysis using the fixed effect model. © Cochrane Library (reproduced with permission).

Lymphadenektomie

- Tendentiell (Izbicki) 38 vs. 47% bzw. signifikant (Sugi) 3 vs. 27% mehr Komplikationen nach systematischer Lymphadenektomie ohne Unterschiede in der Letalität.

Stadium III

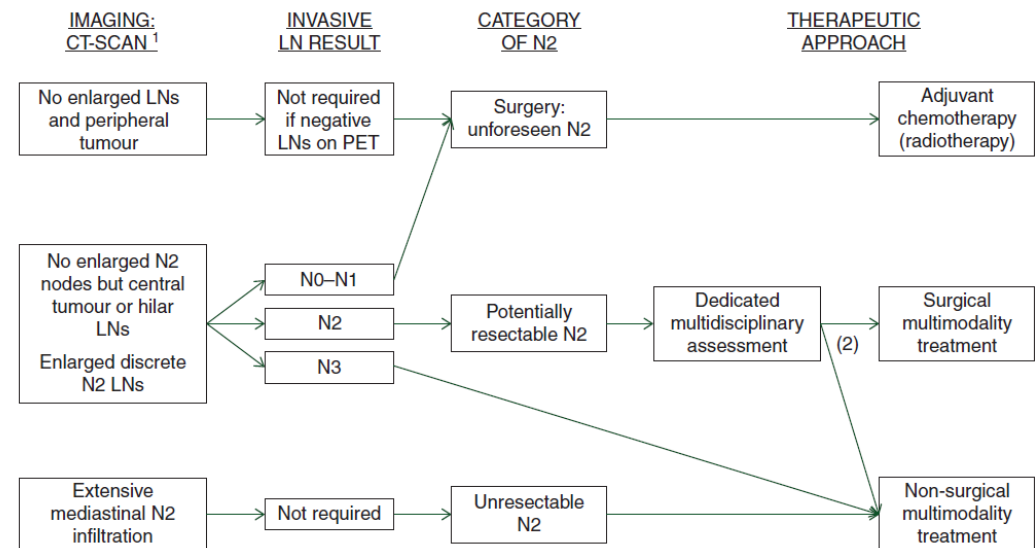
TNM-Staging im Vergleich

| Altes Staging (1997) | Neues Staging (2009) | N0 | N1 | N2 | N3 |
|--------------------------------|----------------------|------|------|------|------|
| T1 (≤2cm) | T1a | IA | IIA | IIIA | IIIB |
| T1 (>2 und ≤3cm) | T1b | IA | IIA | IIIA | IIIB |
| T2 (>3 und ≤5cm) | T2a | IB | IIA | IIIA | IIIB |
| T2 (>5 und ≤7cm) | T2b | IIA | IIIB | IIIA | IIIB |
| T2 (>7cm) | T3 | IIIB | IIIA | IIIA | IIIB |
| T3 (mit Infiltration) | T3 | IIIB | IIIA | IIIA | IIIB |
| T4 (Knoten im gleichen Lappen) | T3 | IIIB | IIIA | IIIA | IIIB |
| T4 | T4 | IIIA | IIIA | IIIB | IIIB |
| M1 (anderer ipsilat. Lappen) | T4 | IIIA | IIIA | IIIB | IIIB |
| T4 (maligner Pleuraerguss) | M1a | IV | IV | IV | IV |
| M1 (kontralat. Lappen) | M1a | IV | IV | IV | IV |
| M1 (Fernmetastasen) | M1b | IV | IV | IV | IV |

Fett gedruckte Zellen markieren Änderungen im neuen Stagingssystem

Quelle: Goldstraw P et al. The IASLC Lung Cancer Staging Project: proposals for the revision of the TNM stage groupings in the forthcoming (seventh) edition of the TNM Classification of malignant tumours. J Thorac Oncol 2007; 2: 706-714

Tab: Vergleich altes und neues TNM-Stagingsystem


¹ Category description according to CT imaging as in ACCP staging document (Chest 143 Suppl 5:211S-250S, 2013), see text for more details.

² See text for factors involved in the choice between non-surgical and surgical multimodality treatment.

Figure 1. Suggested algorithm for treatment in patients with logoregional non-small-cell lung cancer, based on imaging, invasive lymph node staging tests and multidisciplinary assessment. Reproduced from [17], by permission of Oxford University Press, on behalf of ESMO.

2nd ESMO Consensus Conference in Lung Cancer: locally advanced stage III non-small-cell lung cancer

W. E. E. Eberhardt¹, D. De Ruyscher², W. Weder³, C. Le Péchoux⁴, P. De Leyn⁵, H. Hoffmann⁶, V. Westeel⁷, R. Stahel⁸, E. Felip⁹ & S. Peters¹⁰ Panel Members[†]

Annals of Oncology 00: 1–16, 2015

Adjuvante Chemotherapie (frühe-mittlere Stadien)



Table 5. Results of “modern” adjuvant chemotherapy trials

| Study | Stage | <i>n</i> | Therapy | Results | PORT |
|--|---------|----------|-------------------------------------|-----------------------|---------------------------------|
| IALT Collaborative Group [2] | I–III | 1,867 | Cisplatin based | HR, 0.86; $p < .03$ | 27% |
| Winton et al. [8] (JBR.10) | IB–II | 344 | Cisplatin and vinorelbine | HR, 0.696; $p = .012$ | No |
| Strauss et al. [36] (CALGB 9633, 4-yr follow-up) | IB | 344 | Carboplatin and paclitaxel | HR, 0.62; $p = .028$ | No |
| Strauss et al. [37] (CALGB 9633, 6-yr follow-up) | IB | 344 | Carboplatin and paclitaxel | HR, 0.80; $p = .10$ | No |
| Douillard et al. [5] (ANITA) | IB–IIIA | 798 | Cisplatin and vinorelbine | HR, 0.79; $p = .013$ | 28% |
| Scagliotti et al. [3] (ALPI) | I–IIIA | 1,209 | Cisplatin, mitomycin, and vindesine | HR, 0.96; $p = .589$ | chemotherapy, 65%; control, 82% |
| Waller et al. [4] (BLT) | I–III | 488 | Cisplatin based | HR, 1.02; $p = .90$ | No |

Abbreviations: ALPI, Adjuvant Lung Project Italy; ANITA, Adjuvant Navelbine International Trialist Association; BLT, Big Lung Trial; CALGB, Cancer and Leukemia Group B; HR, hazard ratio; IALT, International Adjuvant Lung Cancer Trial; PORT, postoperative radiation therapy.

Bordoni: Consensus Conference: Multimodality Management of Early- and Intermediate-Stage Non-Small Cell Lung Cancer Georgia Cancer Specialists, Atlanta, Georgia, USA *The Oncologist* 2008;13:945–953 (Publikationszeitraum 2003-2006)

Neoadjuvante CRT (St IIIA, N2)



Table 6. Neoadjuvant chemoradiation therapy in N2, stage IIIA, NSCLC patients

| Study | <i>n</i> | CT | RT | RR | 5-Yr survival | Median survival | Postoperative mortality |
|-----------------------|----------|-----|----------------|-----|---------------|-----------------|-------------------------|
| Weiden et al. [42] | 85 | FP | 30 Gy | 56% | 23%, 2-yr | 13 mos | 7% |
| Strauss et al. [43] | 41 | FVP | 30 Gy | 51% | 22% | 16 mos | 15% |
| Albain et al. [44] | 126 | PE | 45 Gy | 59% | 27% | 15 mos | 8% |
| Eberhardt et al. [45] | 94 | PE | 45 Gy | 62% | 31% | 20 mos | 7% |
| Choi et al. [46] | 42 | FVP | 42 Gy (b.i.d.) | 74% | 37% | 25 mos | 5% |

Abbreviations: b.i.d., twice daily; CT, chemotherapy; FP, fluorouracil and cisplatin; FVP, fluorouracil, vinblastine, and cisplatin; NSCLC, non-small cell lung cancer; PE, cisplatin and etoposide; RR, response rate; RT, radiotherapy.

Bordoni: Consensus Conference: Multimodality Management of Early- and Intermediate-Stage Non-Small Cell Lung Cancer Georgia Cancer Specialists, Atlanta, Georgia, USA *The Oncologist* 2008;13:945–953
(Publikationszeitraum 1990er)



All registered patients (N = 579)

Randomly assigned patients

Radiotherapy arm (n = 165)

Surgery arm (n = 167)

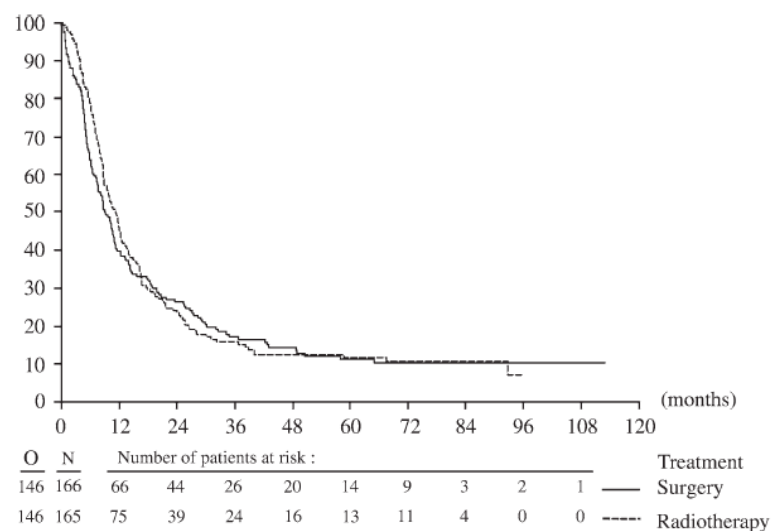


Fig. 3. Progression-free survival rates estimated from time of randomization using Kaplan–Meier analyses. *P* value (two-sided) was calculated using the log-rank test. O = number of deaths; N = number of patients. Hazard ratio = 1.06, 95% confidence interval = 0.85 to 1.33; *P* = .605.

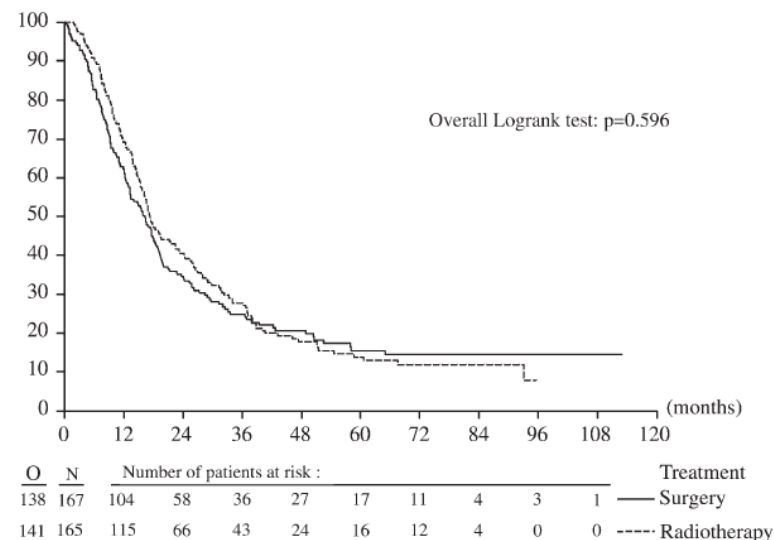
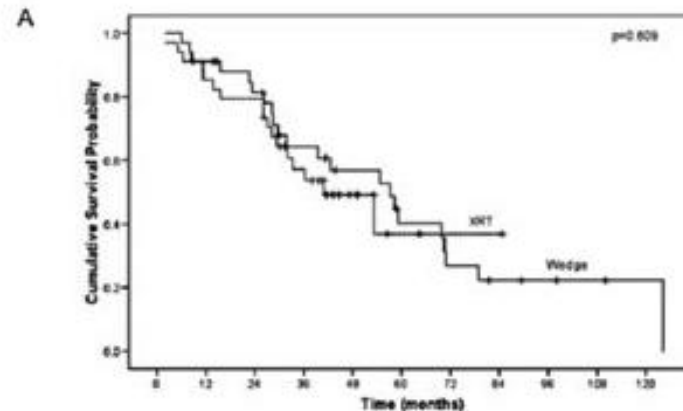


Fig. 2. Overall survival rates estimated from time of randomization using Kaplan–Meier analyses. *P* value (two-sided) was calculated using the log-rank test. O = number of deaths; N = number of patients. Hazard ratio = 1.06, 95% confidence interval = 0.84 to 1.35; *P* = .596.

Van Meerbeeck J. P., Kramer G. W., Van Schil P. E. et al.: Randomized controlled trial of resection versus radiotherapy after induction chemotherapy in stage IIIA-N2 non-small-cell lung cancer. *J Natl Cancer Inst* 99: **442-450** (2007)

Comparison of Limited Surgery and Three-Dimensional Conformal Radiation in High-Risk Patients with Stage I Non-small Cell Lung Cancer

Sai Yendamuri, MBBS,* Ritsuko R. Komaki, MD,† Arlene M. Correa, PhD,* Pamela Allen, PhD,† Bob Wynn, BA,* Shanda Blackmon, MD, MPH,* Wayne L. Hofstetter, MD,* David C. Rice, MD,* Jack A. Roth, MD,* Stephen G. Swisher, MD,* Ara A. Vaporciyan,* Garrett L. Walsh, MD,* and Reza J. Mehran, MD* JTO 2007



6

Conclusion

In selected patients with pathologically proven stage IIIA-N2 NSCLC and a response to induction chemotherapy, surgical resection did not improve overall or progression-free survival compared with radiotherapy. In view of its low morbidity and mortality, radiotherapy should be considered the preferred locoregional treatment for these patients.

J Natl Cancer Inst 2007;99:442-50

- ?a priori inoperabel?

Van Meerbeeck J. P., Kramer G. W., Van Schil P. E. et al.: Randomized controlled trial of resection versus radiotherapy after induction chemotherapy in stage IIIA-N2 non-small-cell lung cancer. J Natl Cancer Inst 99: **442-450 (2007)**



| | CT/RT/S (group 1, n=202) | CT/RT (group 2, n=194) | Total (n=396) |
|--|--------------------------------|------------------------------|------------------|
| Histology | | | |
| Squamous cell carcinoma | 64 (32%) | 65 (34%) | 129 (33%) |
| Adenocarcinoma | 79 (39%) | 82 (42%) | 161 (41%) |
| Large cell | 29 (14%) | 24 (12%) | 53 (13%) |
| Mixed/other NSCLC | 30 (15%) | 23 (12%) | 53 (13%) |
| T stage | | | |
| T1 | 50 (25%) | 47 (24%) | 97 (24%) |
| T2 | 130 (64%) | 121 (62%) | 251 (63%) |
| T3 | 22 (11%) | 26 (13%) | 48 (12%) |
| Number of positive nodal stations reported‡ | | | |
| 1 | 153 (76%) | 146 (75%) | 299 (76%) |
| 2 | 39 (19%) | 39 (20%) | 78 (20%) |
| 3 | 4 (2%) | 4 (2%) | 8 (2%) |
| Unknown | 6 (3%) | 5 (3%) | 11 (3%) |

Kathy S Albain et al.: Radiotherapy plus chemotherapy with or without surgical resection for stage III non-small-cell lung cancer: a phase III randomised controlled trial Lancet 2009; 374: 379–86

CT/RT/S
(group 1,
n=202)

CT/RT
(group 2,
n=194)

Total
(n=396)

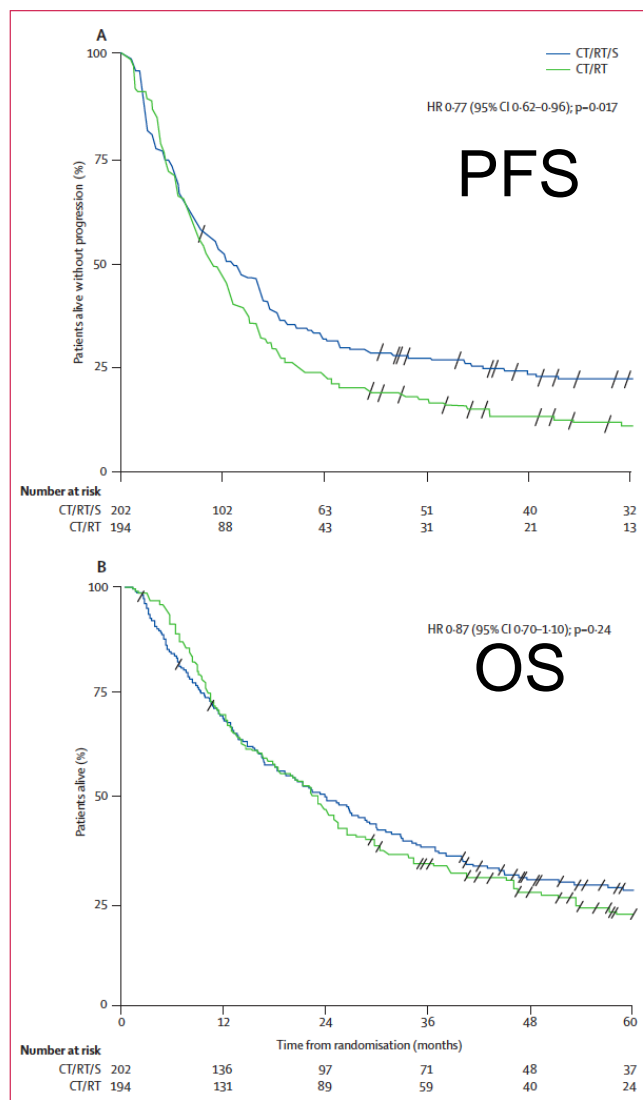


Figure 2: Progression-free survival (A) and overall survival (B) of intention-to-treat population. Slash marks represent censored results. CT/RT/S=chemotherapy plus radiotherapy followed by surgery (group 1, n=202). CT/RT=chemotherapy plus radiotherapy (group 2, n=194). HR=hazard ratio.

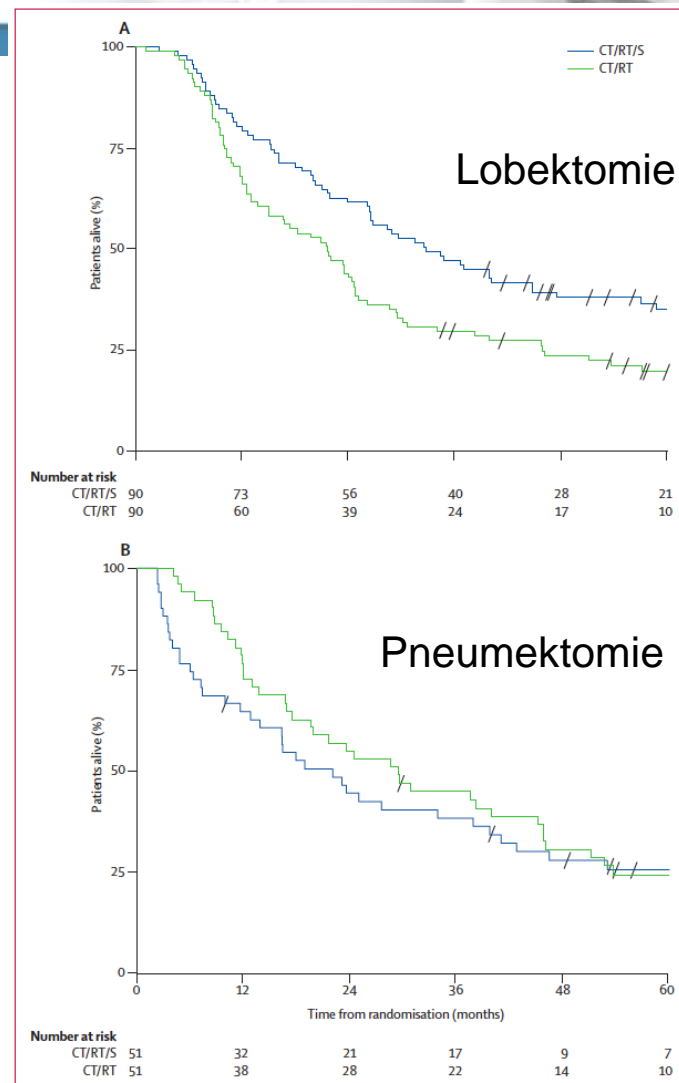


Figure 4: Overall survival of a subset of patients from the intention-to-treat population given lobectomy (A) or pneumonectomy (B) in group 1 versus matched cohorts in group 2. Slash marks represent censored results. CT/RT/S=chemotherapy plus radiotherapy followed by surgery (group 1, n=202). CT/RT=chemotherapy plus radiotherapy (group 2, n=194).



A retrospective review of stage III NSCLC patients treated at the Dana-Farber Cancer Institute/Brigham and Women's Cancer Center

144 (43%) stage III NSCLC
62 (43%) stage IIIA, 82 (57%) stage IIIB.
Radiotherapy was given concurrently with chemotherapy to all patients;
100 patients (69%) received CRT without surgery, and 44 patients (31%) received neoadjuvant CRT followed by surgical resection

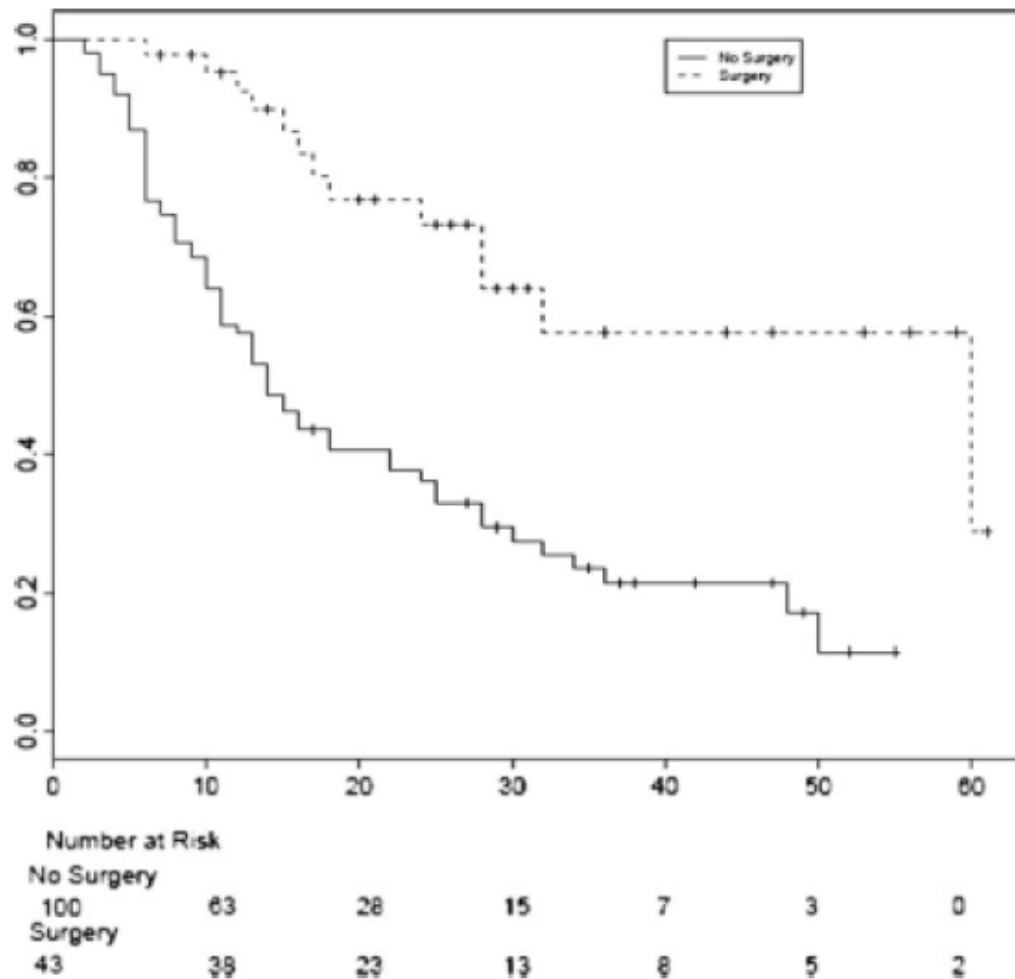


FIGURE 2. This chart illustrates survival difference between the groups who did and did not undergo surgery.



Table 3. Recurrence Patterns in the Surgery and Nonsurgery Groups (Any Site)

| | No Recurrence | LRR Only | LRR and DR | DR Only | Total |
|-----------------------|--------------------------|---------------------|---------------------------|--------------------|--------------|
| Surgery (n=44) | 27 | 0 | 7 | 10 | 44 |
| Nonsurgery (n=100) | 27 | 11 | 39 | 23 | 100 |
| Total (N=144) | 54 | 11 | 46 | 33 | 144 |

LRR indicates locoregional recurrence; DR, distant recurrence.



Chirurgische Therapie I

- **Forderung der Chirurgie:**
 - vor invasiver Diagnostik CT zur Operationsplanung!
 - Hinreichendes Lymphknotenstaging
 - Funktionelle Prüfung
- **Exaktes Lymphknotenstaging Mediastinoskopie**
- **Lobektomie besser als limitierte Verfahren (wedge, Segment)**
- **Sleeve resection besser als Pneumektomie**

Ein höheres Lebensalter sollte kein alleiniger Ausschlussgrund zur Behandlung mit einer Therapiemodalität (Chemotherapie, Radiotherapie, Operation) sein.

Von größerer Relevanz ist das Spektrum der Komorbidität (Lungenreserve)

Stadium I, II Einstzgebiet operativer Verfahren

Rolle der VATS adäquates Verfahren

Chirurgische Therapie II

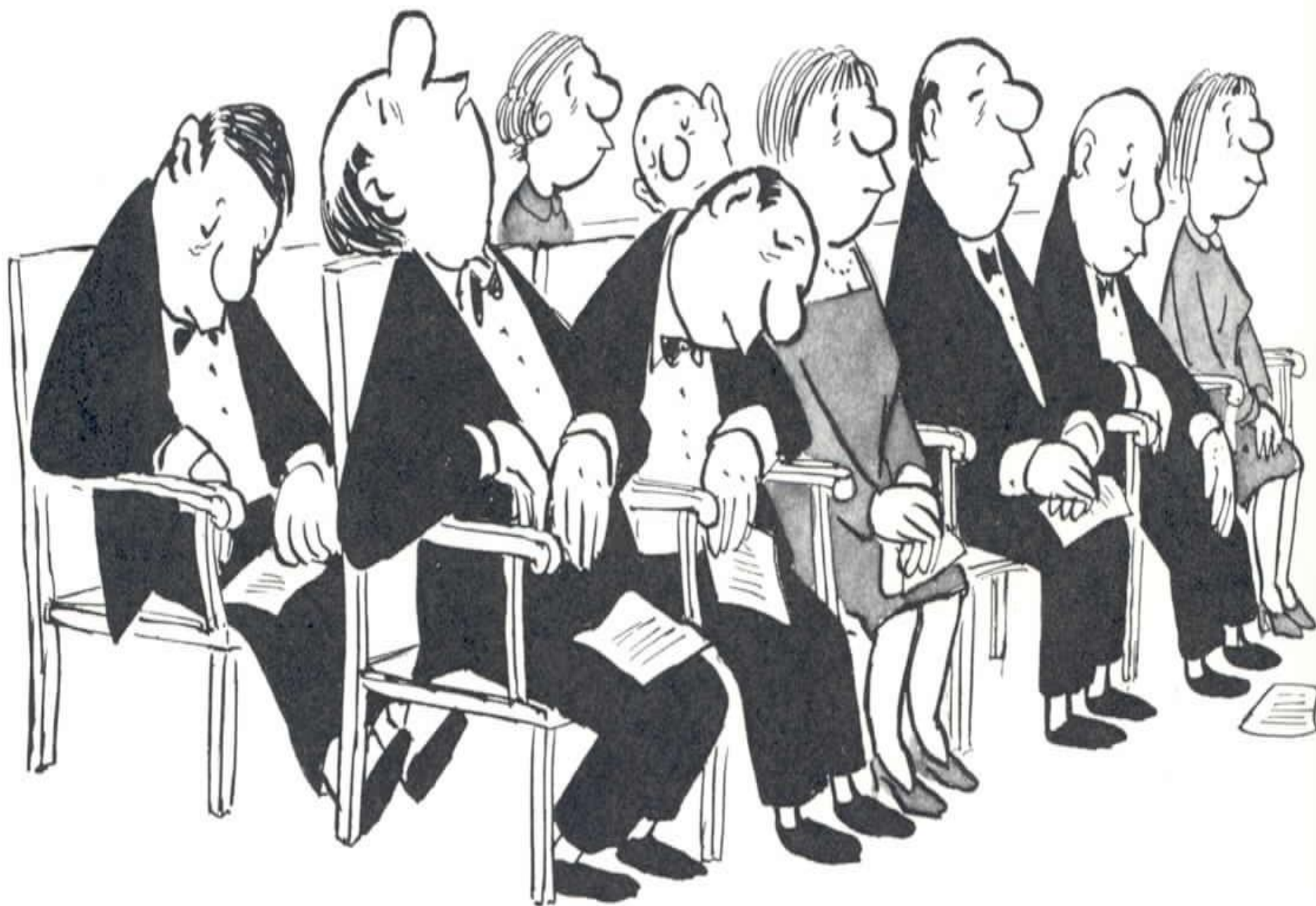


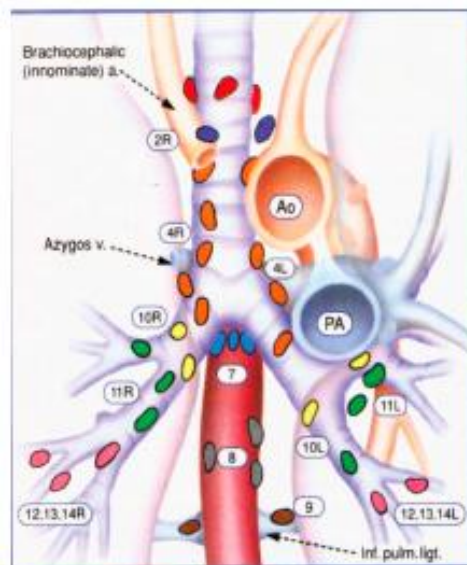
N2:

anatomische Resektabilität \neq funktionelle Resektabilität (niedrige N2 Stadien profitieren, zumindest DFS, Pneumektomien vermeiden)

**prädiktive Faktoren für/gegen Einsatz chirurgischer Maßnahmen fehlen
nach Induktionstherapie Lobektomie besser als Pneumektomie**

- **Bei Lungenkarzinomen mit Brustwandinfiltration ist eine R0 Situation entscheidend, postoperative Radiatio erwägenswert
Bei R1 Resektion Nachresektion bzw. Radiatio**
- **Nur multimodale Ansätze verbessern die Prognose**
- **Das derzeitige Stagingssystem definiert die Rolle und Indikation der Chirurgie ungenügend.**





Superior Mediastinal Nodes

- 1 Highest Mediastinal
- 2 Upper Paratracheal
- 3 Pre-vascular and Retrotracheal
- 4 Lower Paratracheal (including Azygos Nodes)

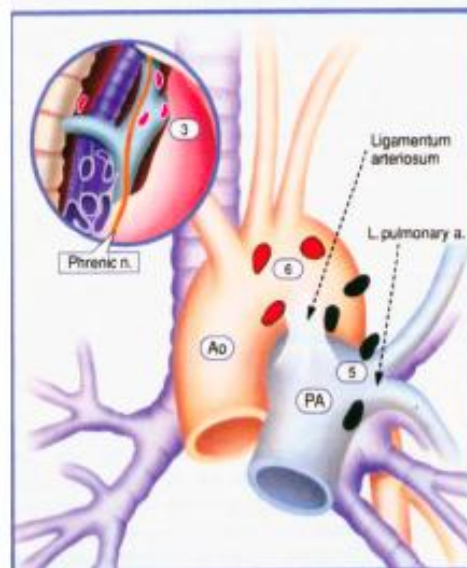
N₁ = single digit, ipsilateral
N₂ = single digit, contralateral or supraclavicular

Upper zone (R)

Aortic Nodes

- 5 Subaortic (A-P window)
- 6 Para-aortic (ascending aorta or phrenic)

AP zone (L)



Inferior Mediastinal Nodes

- 7 Subcarinal
- 8 Paraesophageal (below carina)
- 9 Pulmonary Ligament

Subcarinal zone

Lower zone

N₁ Nodes

- 10 Hilar
- 11 Interlobar
- 12 Lobar
- 13 Segmental
- 14 Subsegmental

Hilar zone

Peripheral zone

FIGURE 2. Mountain-Dresler lymph node map. The lymph node "zones" used for analyses in this study are shown superimposed on the MD-ATS map. From: Mountain CF, Dresler CM. Regional lymph node classification for lung cancer staging. *Chest* 1997;111:1718-1723.³⁰ Used with permission.



- **Danke für Ihr Interesse!**



Bild- und Quellennachweis

- [© H.-H. Jend](#)
- Primal Pictures

