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### 239. Surgery for lung cancer: pre-operative evaluation and results

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#### Late-breaking abstract: The impact of extended cervical mediastinoscopy in staging of left lung carcinoma

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**Background:** Extended cervical mediastinoscopy (ECM) is a method used for staging non-small cell lung cancer (NSCLC).

**Methods:** Between 1998 and 2011, 159 patients underwent ECM who had left NSCLC, were retrospectively analyzed. If the cN2 was limited to the paratracheal or subcarinal spaces without infiltrating the paraortic or subaortic spaces, these cases excluded from the study (negative cases of ECM and positive cases of SCM). Patients who had been reported as cN0 by mediastinoscopy underwent thoracotomy for tumor resection.

**Results:** Localization of the tumor was upper lobe in 81 patients (50.9%), central in 56 patients (35.3%), lower lobe in 22 patients (13.8%). ECM was successful at harvesting one or more aortopulmonary (APW) lymph nodes in 153 patients (96.2%) (#5 and #6 sampling in 82 patients, #5 or #6 sampling in 71 patients). Mediastinal lymph node metastasis was observed in 36 patients (22.6%) via mediastinoscopy. APW lymph node metastases were shown in 26 of these patients (true-positive of ECM), remaining 10 patients who had mediastinal lymph nodes metastasis that could be accessed only via SCM were excluded. 123 patients who identified as cN0 by mediastinoscopy were operated; 64 lobectomies, 43 pneumonectomies, 16 exploratory thoracotomies. The pathological examination of the mediastinal lymphadenectomies revealed APW lymph node metastases in 11 patients (false-negative of ECM). Sensitivity, NPV and accuracy of ECM were calculated as 0.70, 0.91, and 0.92, respectively.

**Conclusions:** ECM has an adequate NPV and accuracy in determining metastases to the APW lymph nodes in patients with left NSCLC

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#### Improvements in lung cancer surgery

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**Background:** Recent trends in outcomes of lung cancer treatment might challenge recommendations for acceptable care.

**Methods:** Using data from the Cancer Registry of Norway, we analyzed outcomes and quality indicators of lung cancer surgery in the periods 1994-1995, 2000-2001 and 2006-2007.

**Results:** A total of 2201 patients were operated on during the study periods. Surgery was performed at 24 hospitals during the first two periods and at 13 in the last. Resection rates varied among counties from 7% to 31%. From the first to the last period, national resection rates increased from 16% to 19% (p for trend=0.001) and one-year survival increased from 73% to 82%. The proportion of resected patients in pStage I-II decreased from 87% to 83% (p for trend=0.048), the proportion of pneumonectomies from 27% to 15% (p for trend<0.001) and the mortality

rate within 30 days of the surgery from 4.8% to 3.0% (p for trend=0.072). In the first two periods, 31% of these early deaths were caused by surgical complications, whereas in the latter period non were. The only unfavorable trend observed was the waiting time from the final diagnostic procedure to surgery, which increased from 29 to 40 days throughout the periods (p<0.001).

**Conclusions:** Important aspects of lung cancer surgery have improved in recent years and the recommendations for certain quality indicators are challenged. The most important is that the resection rates should be further increased towards a putative optimum exceeding 25%.

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#### Role of thoracoscore (thoracic surgery scoring system) in clinical practice

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**Introduction:** Thoracic surgery scoring system (Thoracoscore) a multivariate score with 9 parameters, may predict mortality after thoracic surgery (Lim E. et al. Thorax 2010;65:iii1-iii27). Its role to assess patient fitness for surgery is not clear. Cardiopulmonary exercise test (CPEX) is recommended by ERS to assess fitness for radical therapy in lung cancer patients (Brunelli A. et al. Eur Respir J 2009;34:17-41)

**Objective:** To evaluate role of thoracoscore in patients considered for thoracic surgery.

**Methods:** Retrospective data analysis of patients investigated for thoracic surgery. **Results:** Over a 2 period, 22 patients with borderline lung function had CPEX to assess for lung resection. Based on CPEX, 15 (68%) were fit and had surgery, 7 (32%) were high risk and turned down. Mean predicted death rate based on thoracoscore in patients who had surgery and those who didn't was 3.5% and 3.4% respectively (p=0.95).

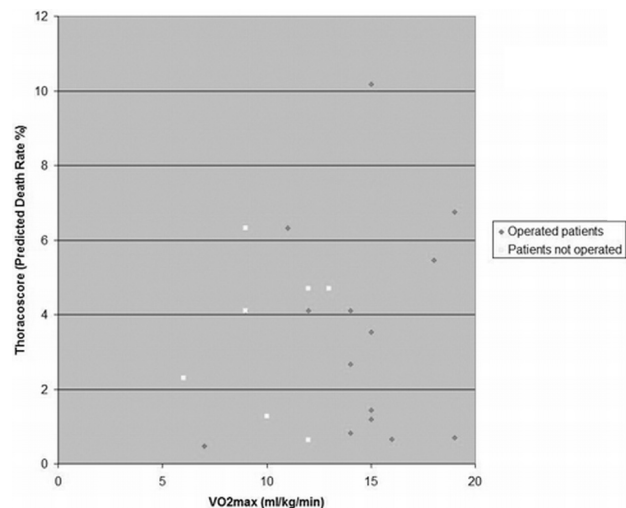


Figure 1

Interestingly, mean FEV1 in those who had surgery and those who didn't was 59% and 66% respectively (p=0.5). The mean peak VO<sub>2</sub> (peak oxygen uptake during CPEX as ml/kg/min) among those who had surgery and those who didn't was 14.2 and 10.1 respectively, with statistically significant difference (p=0.01). There was no post-surgical mortality. Duration of hospital stay did not correlate with peak VO<sub>2</sub> or thoracoscore.

**Conclusion:** Thoracoscore has poor correlation with FEV1 and peak VO<sub>2</sub> and hence is not reliable to triage patients for thoracic surgery.

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#### Vibration response imaging (VRIxp) for calculation of predictive postoperative lung function. Comparison to lung perfusion scintigraphy

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**Introduction:** Radionuclide studies of regional perfusion (Tc) together with lung function tests (FEV1, TLCO) are established methods for predicting pulmonary function after lung resection. The VRIxp (DeepBreeze, Or-Akiva, Israel) records lung sounds, calculates quantitative lung data representing the regional acoustic energy contributed by each lung area. We compared VRIxp with perfusion scintigraphy.

**Methods:** 30 patients (6 F, 24 M age=67±9yrs) with lung cancer (24 lobectomies

and 6 pneumonectomies) were enrolled. VRIxp was scheduled the same day as the perfusion tests. Predicted postoperative FEV1 (FEV1-ppo) was calculated by subtracting the percent blood uptake or percent acoustic energy of the lung to be resected from the total. VRIxp and perfusion results were compared by Pearson correlation.

**Results:** There was a good correlation between VRIxp and perfusion scintigraphy ( $R=0.91$ ). In 80% the difference between both methods was  $<10\%$ . 10 patients had a lung function test at 1-month follow-up. FEV1 values were  $1.55\pm 0.36L$  compared to  $1.56\pm 0.42L$  for VRI-ppo-values. VRI predictions showed a good correlation with FEV1 after surgery ( $r=0.90$ ). 20% of the patients had difference of  $\geq 10\%$  between ppo-FEV1 using VRIxp and actual FEV1.

**Conclusion:** Prediction of postoperative lung function by VRIxp demonstrated a high accuracy compared to perfusion scintigraphy and postoperative lung function. VRIxp can play an important role in prediction of post-operative lung function. VRIxp is non-invasive and radiation free, thus posing no risk to patients. The method needs further evaluation because of possible intraindividual variation ( $>10\%$ ) of the results.

**1912**

**Timed stair climbing to 20 m altitude identifies lung resection candidates with high exercise capacity**

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**Background:** Clinical evaluation for lung resection includes assessment of pulmonary function and maximum oxygen uptake (VO2max). A VO2max of 20ml/kg/min is considered sufficient for pneumonectomy. Stair climbing as a low-cost alternative to formal treadmill cardiopulmonary exercise testing (CPET), is attractive but lacks standardisation.

**Methods:** We asked 40 lung resection candidates (bronchiectasis or aspergilloma, n=31; lung cancer, n=7; hydatid cyst, n=2) with FEV1 and/or DLCOc  $<80\%$  predicted (mean age: 43.7y; mean FEV1: 49.7%; mean DLCOc: 56.9%; 30 pts with FEV1/FVC  $<70\%$ ) to climb to a maximum of 20m elevation as high and as fast as they could. Time of ascent to 20m and elevation reached were measured. Peak VO2 achieved during stair climbing and CPET were compared (MetaMax II, Cortex, Germany).

**Results:** Mean elevation reached was 17.2m. Mean peak VO2 during stair climbing was very similar to that during CPET (23.5 vs. 23.6ml/min/kg,  $p=0.87$ ). Twenty-four patients (60%) reached 20m. There was a good linear correlation between speed of ascent and peak VO2 ( $r=0.63$  for stair climbing and 0.67 for CPET), but 4 of those patients (17%) remained below a peak VO2 of 20ml/kg/min. However, all 16 patients (67%) who reached 20m and climbed with a speed of  $>15m/min$  had a VO2 peak of  $>20ml/min/kg$  during stair climbing and CPET. No patient with a FEV1  $<40\%$  could climb to 20m or ascend faster than  $>15m/min$ .

**Conclusions:** Speed of ascent of  $>15m/min$  accurately identifies patients with a peak VO2 of  $>20ml/min/kg$ , thereby obviating the need for CPET in those patients.

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**Prediction of postoperative FEV1 and chronic dyspnoea using quantitative computed tomography (CT) in lung resection candidates**

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**Aim:** Preoperative evaluation of lung function before lung resection is necessary in order to avoid postsurgery morbidity. The aim of the study is to evaluate the role of quantitative CT in predicting postoperative FEV1 and patient's chronic dyspnoea.

**Methods:** Twenty-eight patients with non-small cell lung cancer have been evaluated. Lung function tests (LFTs) and chest CT scan were performed preoperatively. Fifteen patients (group A) had normal LFTs, thirteen patients (group B) had impaired lung function, requiring further testing. Quantitative evaluation of CT using dual threshold (-910 up to -500 Hounsfield Units) estimated total functional lung volume and the volume of the lobe(s) to be resected. Postoperative FEV1 was predicted by reducing the preoperative value by the same fraction that the resected part contributed to the total lung volume, in both groups. Postoperative LFTs were performed 3 months after surgery. Postoperative dyspnoea was evaluated using the modified Medical Research Council (mMRC) scale.

**Results:** The postoperative predicted and postoperative actual values of FEV1 were significantly correlated in both groups (Group A:  $r=0.897$ ,  $p<0.0001$ , Group B:  $r=0.940$ ,  $p<0.0001$ ). Predicted volume loss as a percentage of total lung volume correlated significantly with postoperative mMRC ( $r=0.647$ ,  $p<0.001$ ).

**Conclusion:** Quantitative CT in patients undergoing lung resection appears to be a useful tool in evaluating postoperative patient's status as it predicts postoperative FEV1 and postoperative mMRC.

**1914**

**FEV1 is not a prognostic marker in operated patients with stage I or II non-small cell lung cancer (NSCLC)**

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**Background:** In retrospective studies lung cancer mortality was found to be higher in patients with chronic obstructive pulmonary disease (COPD), defined as a FEV1  $\leq 70\%$  of the predictive value. In the Cher@Nostrial and the Paccora trials, based on patients with unresectable clinical stage III, a strong relationship was observed between FEV1 and overall survival (OS). In a smaller study FEV1 was a prognostic factor for OS in operated patients (Nakajima et al. Thor Cardio Surg 2009;57:339-342).

In our study we investigated whether the presence of COPD is a prognostic marker in patients with resectable stage I and II NSCLC.

**Methods:** All relevant clinical information was gathered retrospectively from 77 patients undergoing complete resection without preoperative chemo- or radiotherapy between January 2003 and January 2006.

All patients were staged according to the 7th TNM-classification.

Primary endpoints were OS and progression-free survival (PFS).

Follow-up information was complete for all patients and ended in July 2010.

Patients were classified as having a FEV1  $\leq 70\%$  or a FEV1  $>70\%$ .

**Results:** According to the Kaplan Meier analysis (log rank test) FEV1 was not a significant prognostic factor for OS [ $p=0.461$ ] or PFS [ $p=0.530$ ]. In a Cox multiple regression analysis the adjusted hazard ratio for FEV1 (measured on a continuous scale) was 1.632 ( $p=0.458$ ) after adjustment for stage and age.

**Conclusion:** In contrast to other studies our data show that FEV1 is not a prognostic factor in patients with resectable stage I and II NSCLC. Precise selection criteria regarding cardiopulmonary function excluding patients with a very poor cardiopulmonary function, could be responsible for this finding.

**1915**

**Lobectomy tolerance in COPD patients**

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Lung cancer is often associated with COPD. COPD patients have higher postoperative risk because of low respiratory reserve. Morbidity and mortality in these patients mounts to 60% and 10-14% respectively (Sekine Y., 2001, Subotich D., 2007).

**Aim:** To investigate factors influencing the risk of postoperative morbidity and mortality and to determine criteria for lobectomy intolerance in COPD patients.

**Material and methods:** 279 patients underwent lobectomy from 2001 to 2008 were included in a retrospective study. Mean age was  $61\pm 12$ , male/female ratio - 204/75. Patients were divided in three groups according to recommendation of GOLD 2007. Group 1 - 154 non-COPD patients, group 2 - 47 patients with mild COPD and group 3 - 78 patients with moderate to severe COPD. Comorbidity of the patients was assessed by using of Charlson comorbidity index (CCI).

**Results:** Morbidity and mortality were found to be increased in patients with more severe obstruction. Thus morbidity was 32% in nonCOPD patients, 34% - with mild COPD and 46% - with moderate to severe one. Mortality was 3.9, 8.5 and 12.8% respectively.

However multivariate analysis showed that severity of COPD and predicted postoperative FEV1 were not independent factors of morbidity and mortality.

Mortality in patients with ppoFEV1  $<40\%$  was 5%, whereas it was 7% in group with ppoFEV1  $\geq 40\%$ .

CCI was found to be the only independent risk factor. Morbidity in patients with CCI  $\geq 6$  was 100%. Combination of CCI  $\geq 6$  and ppoFEV1  $<50\%$  was accompanied by very high risk of mortality (mounted 70%).

**Conclusion:** ppoFEV1  $<40\%$  is not independent criterion of lobectomy intolerance in COPD patients. Significant factor of functional inoperability is combination of CCI  $\geq 6$  and ppoFEV1  $<50\%$ .