369. Pre-operative evaluation in thoracic surgery

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Study of compensatory lung growth after right bilobectomy in a COPD experimental model

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Lung volume reduction surgery (LVRS) is one of the surgical approaches performed in COPD patients waiting for lung transplant. We hypothesized that compensatory lung growth (CLG) after LVRS is important to explain the improvement of life quality in these patients after LVRS. We investigated the CLG physiological effects after right bilobectomy (LBX) in a COPD rodent model. Sixty-four rats were assigned in 4 groups: saline+sham LBX (SS), saline+LBX (SO); elastase+sham LBX (ES); and elastase+LBX (EO). Forty days after instillation with elastase (5UI/100g) or saline, animals were underwent to sham surgery or right LBX (middle and cardiac lobes). Eight animals from each group were killed after 2 (T1) or 4 (T2) weeks and ventilatory parameters, lung tissue remodeling, gas exchange area and inflammatory cells were measured. All elastase-treated animals showed a typical destruction of lung parenchyma architecture with a decrease in elastic fibers amount (11.1±4.1 and 9.4±2.7%, saline and elastase, respectively, $p<0.05$) and an increase in average alveolar diameter (Lm) (66.5±6.1 and 94.3±18.6μm, saline and elastase, respectively, $p<0.05$) and collagen fibers proportion (8.6±1.6 and 11.7±1.4%, saline and elastase, respectively, $p<0.05$). The CLG observed in elastase-treated animals after LBX was followed by a decrease in Lm (94.1±13.9 and 76.8±10.9 μm, ES and EO, respectively, $p<0.05$), and an increase in lung elastance (1.2±0.1 and 1.6±0.3cmH_2O/mL/s, ES and EO, respectively, $p<0.05$) and elastic fibers (8.5±1.1 and 13.1±1.1%, ES and EO, respectively, $p<0.05$). We conclude that the compensatory lung growth after LBX plays an important role in the improvement of lung elasticity and function in COPD animals.

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The use of respiratory functional imaging to get better understanding of lung resection surgery

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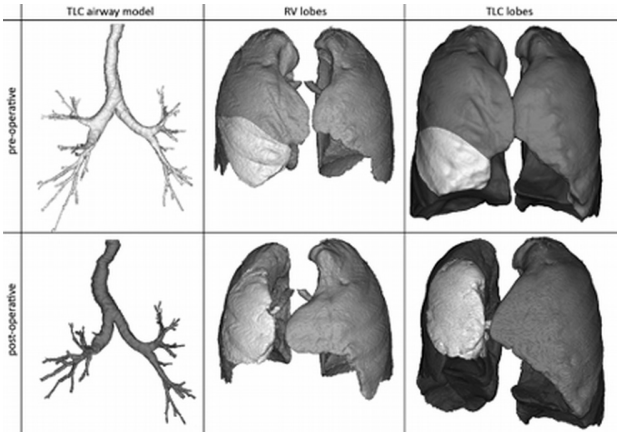
Aim: The aim of the present study was to get a better understanding of the impact of lung resection surgery (LRS) on the respiratory function using respiratory functional imaging (RFI).

Method: 7 patients underwent either a single (5/7) or double lobectomy (1/7), or a full pneumectomy (1/7). All patients underwent lung function tests and CT based RFI providing imaged Raw (iRaw), airway volume (iVaw) and internal flow distribution before and after surgery.

Result: LRS causes deformation of the airways (see figure), a significant drop in FEV1 (p=0.02), TCO (p=0.02) and VA (p=0.02) and an increase in Raw (p=0.03). RFI shows decreased airway volume (iVaw,p=0.02) and increased resistance (iRaw,p=0.02). Changes in both iVaw and iRaw did correlate with changes in FEV1 (p=0.007 and p=0.02). If iVaw, iRaw and lobar flow were recalculated



after virtual resection, these data did correlate well with the observed postoperative data (R^2=0.8,p<0.01; R^2=0.55,p<0.01; R^2=0.45,p<0.01).
Conclusion: RFI does provide insights in the influence of LRS on the postoperative airway volumes, resistances and internal flow redistribution and can be used to predict post-operative lung mechanics.

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Intraoperative marking of a small pulmonary nodule with the multi-axis angiography system
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Introduction: Often cases are difficult to identify the localization of small pulmonary nodule during operation, preoperative CT guided marking have been described. However, there were some problems including air embolism, pneumothoracs or detection ratio. Now, we used Artis zeego (Siemens co ltd, Germany) which drew up a CT-like image during operation to determine the localization of the tumors for some cases. This is the first report of intraoperative marking using the Artis zeego.
Material: Artis zeego is the first multi-axis angiography system based on robotic technology that can be positioned the way a physician wants. It can be controlled with far greater ease and precision than conventional C-arm system.
Methods: The patient was fixed lateral position under general anesthesia, and was sterilize and draped on the operation table. After marking to the pleura where was predicted the nearest portion from the nodule with a clip under the VATS view, Artis zeego was entered and provide a CT-like image. After Artis zeego was disconnected from the patient, the excision region was determined by the image.
Results: Four patients, five small pulmonary nodules were performed this procedure. All regions were successfully detected by the image and removed completely. Since this system did not provide to detect pulmonary regions, there were some problems including narrowing of the bed for lateral position, the little device, the elbow or equipments were easy to strike on the machine when rotation.
Conclusions: This procedure could be an extremely useful and safety method for intraoperative marking a small pulmonary nodule. We also need to resolve some problems of this procedure such as the devices.

3303
The concept of prevention of postoperative respiratory complications in lung surgery
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Objectives: Disciform atelectases can be a predictor of a severe postoperative respiratory complications. The aim of the study was to elaborate a set of measures aimed at prevention of these complications in patients subjected to operations on the lungs.
Materials and methods: We compared two comparable (in terms of surgery, comorbidities, age) groups of patients underwent lung resection. Two modes of ventilation were used during the operation. In group I (n = 313) ventilation regimen was CMV, standard techniques were used to create expiratory training with PEEP 2). In group II (n = 310) high frequency jet ventilation (HFJV) was carried out (VT = 2 ml • kg-1; f = 100 min-1; I: E = 1:2). In the postoperative period in group I traditional ventilation was conducted. In group II non-invasive mechanical ventilation (Noninvasive HFJV) was used in Continuous Positive Airway Pressure mode (VT = 2 ml • kg-1; f = 300 min-1; I: E = 1:1), inspiratory training was applied. Chest radiograph was undertaken next day after surgery.
Results: In Group II, compared with the group I reduction in the incidence of disciform atelectases was noted in first two days after surgery by 3.4 times.
Conclusion: On the base of the results obtained we formulated the concept of prevention postoperative respiratory complications after lung resections, which is as follows: 1.Intraoperative - conducting HFJV mode VPN, 2. On the first day after surgery, x-ray control to detect the beginning of the disciform atelectases 3. Holding in the immediate postoperative period of non-invasive mechanical ventilation in mode CPAPHF 4. In the delayed postoperative period breathing exercise to improve the expanding of the lungs.

3304
Exercise test as preoperative predictor before pulmonary resection surgery
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Exercise test (V02) before pulmonary resection surgery was incorporated into the new guidelines (A.Brunell Eur Respir J 2009; 34: 17-41) in the case that the patient presents a FEV 1 and/or TlCO < 80% predicted, assuming that the exercise test reproduce the situation of cardio-respiratory overload that occurs during the surgical intervention.
Material and methods: Prospective descriptive study, three months, which included 48 patients evaluated for possible lung resection due to lung neoplasm who presented values less than 80% in the FEV1 or TlCO and preformed a maximum exercise testing to complete the preoperative assessment.
Results: Mean age (65±8 years); 41 M, 7F. According to the retrieved V02 patients were divided in 3 groups and comparing the values of the FEV 1 and TlCO in each group Table I.
25 patients presented a DLCO and FEV1% < 80%, of them 4 presented a V02 between 10-15, 14 between 15-20 and 7 > 20. Correlations between FEV1 vs VO2 (0,478,P < 001) and VO2 vs TlCO(0,287, P<0,065)
28/48 patients were operated and in the postoperative follow up(1 month) there was no death and 8 (28.5%) of them had postoperative complications (2 empyema, 2 hemothorax, 1 fistula, 2 pneumonia, 1 respiratory failure). These patients presented the following functional parameters FEV1 1686ml, DLCO 51.8%, 17.4 ml/kg/min V02.

	VO2 (ml/kg/min)	N	Mean	p
FEV1%	< 10	0	0	
	10-20	24	60,61±17,30	0,002
	> 20	15	73,00±15,82	
TlCO	< 10	0	0	
	10-20	22	60,74±17,97	P,009
	< 20	15	78,13±19,12	

Conclusions: Patients with mechanical and/or decreased gas exchange (< 80%), present a lower (V02 max.) The use of the algorithm that includes as initial step exercise test predicts a good postsurgery evolution.

3305
Six minute walk test (6MWT) in patients with diagnosis of lung cancer – Clinical value in physiological evaluation candidates for surgical treatment
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The lung function testing (LFT) and assessment of exercise capacity in patients with lung cancer are important tools for qualification for the surgery and estimation the risk. However the commonly used 6MWT is not recommended by the current guideline as a reliable method of evaluation (Brunelli 2009).
The aim of the study was to analyze the differences in LFT and 6MWT between patients with and without complications after lung resection. The analysis included 127 operated pts (mean age 63,1±9,3 yrs, 80 M, 47 F), with histopathologically confirmed NSCLC. Patients with a history of previous lung resection, chemotherapy or radiotherapy were not included into the study. The comparison of LF and 6MWT was performed and the differences between pts without (86 pts) and with (41 pts.) postoperative complications (e.g. arrhythmias, PAL, hemorrhage) were noted: FEV1 2,4 vs. 2,1L p=0,01 (91,3 vs. 75,5%, p<0,001), FEV1%FVC 69,2 vs. 60,3% (p<0,001), ppoFEV1 1,9 vs. 1,6 L, p = 0,01 (71,9 vs. 51,3%, p<0,001), 6MWT distance 430 vs. 415m (ns), SaO2 start 96,9 vs. 95,5% (p<0,001), SaO2 min 95,1vs. 92,2% (p<0,001). In univariate analysis ppoFEV1%pred., 6MWT distance and minimal value of SaO2 during the test were significant prognostic variables.
Conclusions: Patients with postoperative complications had lower lung function indices (FEV1, ppoFEV1) and lower minimal saturation during 6MWT than those with uneventful postoperative course. Those findings suggest that 6MWT, highly reliable in estimating exercise tolerance in COPD patients, ILD and IPAH, can be valuable also in assessment of lung cancer patients, candidates for surgical treatment.

3306
Effect of pre-operative short-term rehabilitation on peak VO2 in patients with NSCLC
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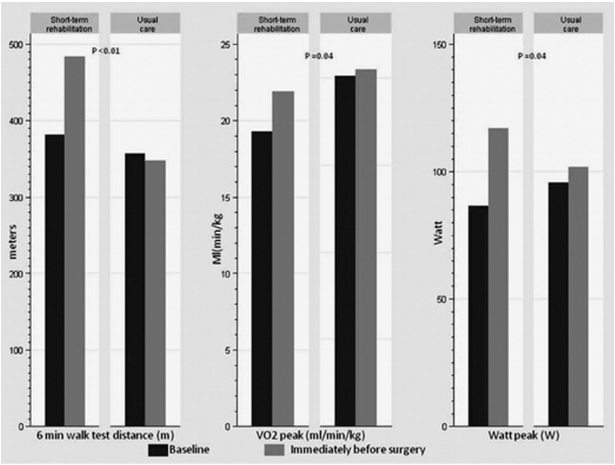
Preoperative fitness is best assessed with cardio-pulmonary exercise testing (CPET) in patients with non-small cell lung cancer (NSCLC). Peak Oxygen consumption (VO2 peak) is predictive of short-term complications after thoracic surgery. Feasibility and effect of short-term (2 to 3 weeks) rehabilitation on fitness and short-term outcomes are unknown.
We planned a pragmatic, randomized controlled trial (RCT) comparing short-term rehabilitation (R) with usual care (UC) in patients with operable NSCLC.
Method: This ongoing study enrolls patients after baseline CPET from 2 centres in

Switzerland. Intervention: preoperative three-times a week, intensive, respiratory physiotherapist supervised interval training. Controls: usual care
Outcomes: Post-operative complication rate, short-term change in VO2 (baseline and immediately before surgery), long-term fitness and quality of life.
Results: Up to december 2011, 65 patients were randomized, R n=31, UC n=34 (mean age 63.4 [10.5], FEV1 86.7% [23.5], DLCO 70.5% [19.0], VO2 peak 19.5 ml/min/kg [5.7] watt peak 86 W[38], 6MWT 370 m [101]). As reassessed immediately before surgery VO2 peak (+2.3 [0.7] ml/min/kg, p=0.04), watt (+15.5 [4.6] W, p=0.04), 6MWT (+87 [15.5] m, p<0.01) improved in R but not in UC patients.



Conclusion: This interim analysis shows that short-term intensive rehabilitation is feasible and improves fitness before surgery in patients with resectable NSCLC.

3307
Structured light plethysmography for the non-contact estimation of chest and abdominal motion changes after thoracic surgery: pilot experience
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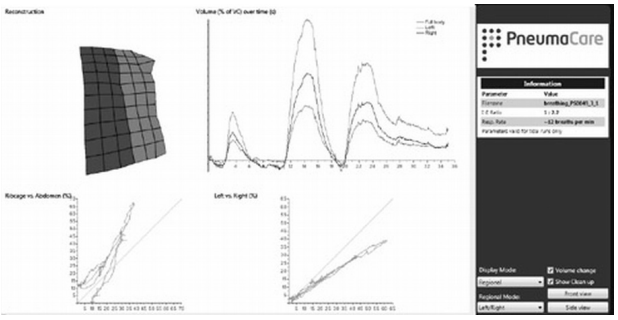
Introduction: Structured Light Plethysmography (SLP) is a non-contact method of studying chest and abdominal motion. SLP allows a representation of chest and abdominal wall movement which can relate to tidal and spirometic volumes. This can also be studied with a 3D-viewer.
Methods: We obtained serial data from 10 patients who underwent thoracic surgery. They were scanned pre and postoperatively with a PneumaScan-P2™ device (PneumaCare, Cambridge, UK). A checkerboard grid of light was projected onto the patients' chest area. Two digital cameras, recorded the grid movement during breathing. Data was presented as a respiratory volume trace over time and as Konno-Mead plots for left v right hemi thorax and chest v abdomen movement. A post operative patient is shown in figure 1.



Results: In some patients following thoracic surgery we demonstrate reduced chest wall motion on the operated side. We find improvements in chest wall movement over the recovery period. In one patient no significant difference in pre and post op scans can be found. This patient had virtually no pain post-op and returned to work 5 days after his limited thoracotomy and lung resection.
Conclusions: SLP can objectively measure chest wall movement in thoracic surgery patients. There may be a role for it in monitoring post-operative recovery and we are exploring this further.