

## Angioinvasion significantly affects long-term survival in NSCLC patients

ID: 298

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### Background:

Non-Small Cell Lung Cancer is still one of the leading causes for death worldwide. Therapy-determining staging systems underly necessarily continuous reevaluation. In particular, tumor size, lymph node involvement, and distant metastasis are paramount in defining therapy. Recent studies have shown that Haemangiosis Carcinomatosa (V1) impacts the long-term survival of patients with Non-Small Cell Lung Cancer (NSCLC). The aim of the present study was to emphasize blood-vessel invasion (BVI) as an independent risk factor. We analyzed the effect of V1 on survival in UICC stage I, II and III postoperative NSCLC-patients.

### Materials and methods:

This retrospective study consists of 747 consecutive patients with NSCLC, who underwent an anatomical resection and radical lymphadenectomy at our institution between January 2012 and December 2020. V1- were compared to V0-patients (absence of Haemangiosis Carcinomatosa). All patients received adjuvant chemotherapy according to European guidelines. 1-, 3- and 5- year survival rates were assessed by Kaplan-Meier method. To proof V1 as an independent risk factor, a propensity score matched analysis was performed regarding specific parameters like age, sex, UICC-stage, lymph-node involvement, and comorbidities followed by a cox regression analysis.

### Results:

A total of 461 patients (V0: 440; V1: 21) were included in this analysis. Baseline characteristics were comparable. Mean age in V0-group was 65.7±10.5 years and 64.1±8.6 years in V1-group (p-value=0.5). 54.8% of V0-patients were male, while 66.7% were male in V1-group (p-value=0.37). Mean survival in V1-group was significantly shorter compared to V0-group (V1: 45.8±9.3 months; V0: 81.1±1.1 months; p-value<0.001). This was confirmed by propensity score matched analysis (V0: 99.9±4.9 months; V1: 45.7±9.3 months; p-value<0.001). The 1-, 3-, and 5-year survival rates were significantly lower in V1 patients (1-year: V0: 100%; V1: 70.6%; p-value=0.012) (3-year: V0: 95.2%; V1: 46.2.9%; p-value=0.002) (5-year: V0: 90.5%; V1: 36.4%; p-value=0.003) after propensity score matching. Cox regression analysis yielded a hazard ratio for V1 of 11.4 with an 95% CI 2.32-56.09 and a p-value of 0.003.

### Conclusion:

Our investigations suggest, that V1 is an independent risk factor for long-term survival in patients with non-small cell lung cancer. Therefore, we recommend including V0/V1 in pathological reports. Until a clear therapy recommendation finds its way into the current guidelines, we encourage the treating physicians to evaluate the necessity of an adjuvant therapy as an individual therapy concept within the framework of an MDT. From our point of view, blood vessel invasion should have an impact on adjuvant therapy in NSCLC patients. Due to our small but specified sample size, our statement should be confirmed by a multicenter study.

## Is adjuvant radiochemotherapy justified for single-level skip pN2 NSCLC patients?

ID: 300

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### Background:

Histopathological staging with a therapeutic consequence in NSCLC patients contains description of the tumor-size and investigation of lymph-node and/or distant metastases (TNM). T and M descriptors have continuously changed since development of the TNM classification for lung cancer in 1966. The N descriptor is a key determinant of prognosis and plays a central role in the staging classification. We reviewed the accuracy of the N descriptor by analyzing and comparing survival data of pN1-, single-station skip pN2 and all other pN2 non-small cell lung cancer (NSCLC) patients in a consecutive cohort.

### Materials and methods:

747 UICC-stage I-III patients underwent lobectomy and radical lymphadenectomy between January 2012 and December 2020 at our institution. Patients were divided into three groups. pN1 (n=88) were defined as patients with proof of metastases (MTS) in pN1 lymph-nodes (LN), pN2a (n=22) as proof of MTS in a single-station of pN2 LN. Finally, pN2b (n=61) were characterized as patients with proof of MTS in multiple-station pN2 LN and pN1 LN. Pearson's chi-square -, Fisher exact-, and Student t-test were performed. Mean survival, 1-year, 3-year, and 5-year overall survival were calculated. Survival rates were assessed by Kaplan-Meier method and log-rank test.

### Results:

A total of 171 consecutive patients were included for further analysis. Baseline characteristics were comparable. Mean age in pN1-group was 64.4±8.9 years and 62.9±7.9 years in pN2a group (p-value=0.47). 63.6 % of pN1-patients were male, while 54.5% were male in pN2a-group (p-value=0.46). There was no significant difference concerning mean survival in pN1-group compared to pN2a-group (pN1: 64.5±5.1 months; pN2a: 51.0±5.0 months; p-value=0.849). Furthermore, one-year, three-year and five-year survival did not differ significantly. However, the survival rates of the pN1-group in comparison to the pN2b-group presented significant differences in all calculated survival rates.

### Conclusion:

Based on our data, single-station skip-N2 MTS NSCLC patients show similar survival rates as patients with MTS in pN1 LN. Patients with multiple-station pN2 MTS or an additional pN1 involvement (pN2b) present substantially decreased survival-rates. A revision of the N descriptor with regards to the establishment of an adjuvant treatment should be performed. A further differentiation among pN2 patients could lead to a more personalized treatment.

## **Risk factors for surgical complications after anatomic lung resections in the era of VATS and ERAS**

ID: 384

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### **Background:**

The aim of this study was to identify risk factors for surgical complications after anatomic lung resections in the era of video-assisted thoracic surgery (VATS) and enhanced recovery after surgery (ERAS).

### **Materials and methods:**

A retrospective analysis of all consecutive adult patients who underwent elective anatomic lung resections between January and December 2020 at our institution was performed.

### **Results:**

Eighty patients (40 VATS, 40 thoracotomy) were included. The 30-day mortality rate was 1.3%. The overall rate of major postoperative complications was 18.8%. Most major complications occurred in patients who underwent open surgery (complication rate 32.5%, share of total complications 86.7%). Major morbidity after VATS resection was rare (complication rate 2.5%, share of total complications 13.3%). In univariable analysis, thoracotomy ( $p=0.003$ ), impaired preoperative lung function ( $p=0.003$ ), complex surgery ( $p=0.004$ ) and sleeve resection ( $p=0.037$ ) were associated with adverse outcomes. In multivariable analysis, thoracotomy ( $p=0.044$ ) and impaired preoperative lung function ( $p=0.028$ ) were the only independent risk factors for major postoperative morbidity.

### **Conclusion:**

Thoracotomy was associated with a 10-fold increased risk for postoperative complications compared with minimally invasive surgery and was an independent risk factor for surgical complications. In the era of VATS and ERAS, the fact that thoracotomy is performed may be a reliable parameter to identify patients at risk for postoperative complications.

## Rare case of a covered rupture of the thoracic aorta as a complication after kyphoplasty

ID: 617

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### Background:

Kyphoplasty and vertebroplasty are common methods to treat thoracic and lumbar osteoporotic vertebral body fractures and have been proven effective in providing pain relief. Both methods can lead to complications. The most common complication is local cement leakage into the surrounding tissue. In addition, new fractures in neighboring vertebral bodies, pulmonary cement embolism as well as infections can occur. Most of these complications are rare but sometimes life-threatening. We present the rare case of a 58-year-old patient several weeks after kyphoplasty with extensive spondylodiscitis of the thoracic vertebral bodies 5-9 with accompanying staphylococcal sepsis and a subacute rupture of the descending aorta at the level of the thoracic vertebral body 7 where cement leakage had occurred.

### Materials and methods:

The patient was treated with cortisone for many years because of a severe COPD stage Gold IV in addition to long-term oxygen therapy. In 2019 endoscopic lung volume reductions of the left and right upper lobes were carried out with coils. As a side effect of the cortisone therapy the patient had developed severe cortisone-induced osteoporosis, which had led to various sintering fractures of the thoracic and lumbar vertebral bodies with accompanying pain symptoms. Therefore several times these fractures were treated with a kyphoplasty. In some cases this treatment leads to cement leakage into the surrounding paravertebral tissue. Most recently newly occurring sintering fractures of thoracic vertebral body 12 and lumbar vertebral bodies 1 and 2 were again treated with kyphoplasty in February 2021. During hospitalization the patient developed a nosocomial Covid-19 pneumonia which was successful treated with remdesivir and high-flow oxygen therapy so that he could be transferred in rehab. From rehab the patient was transferred back to our pulmonology clinic with productive cough symptoms under suspicion of a pneumonia recurrence and with accompanying pain symptoms in the spinal area.

### Results:

At admission significantly increased infection parameters were conspicuous whereby a Covid-19 reinfection could be ruled out. However Staphylococcus aureus could be isolated in the blood culture, whereby pneumonia could be excluded as the causal focus. Clinically the patient presented with significant pain in the thoracic spine, so that as part of the focus search an MRI examination of the spine was carried out in which acute spondylitis and spondylodiscitis of the thoracic vertebral bodies 5 to 8 with accompanying paravertebral abscess was described. Therefore our trauma surgeons presented us the MRI images for co-assessment. We had the suspicion of a covered perforation of the descending aorta at level of the vertebral body 7 in the area of cement leakage. An angio-CT was initiated as an emergency. Angio-CT confirmed an perforation of the thoracic aorta at the level of thoracic vertebral body 7 with accompanying paravertebral soft tissue abscess. Emergency vascular surgery was carried out with an endovascular thoracic prosthesis. Four weeks after the intervention, the patient was able to be discharged in a stable, chronically reduced state under long-term antibiotic therapy.

### Conclusion:

Even if complications after kypho- and vertebroplasties are rare, they can be serious and life-threatening. Cement leakage are seen more often, but are usually harmless. In very rare cases, infections or arrodng of surrounding structures, such as vessels, can occur. It is then crucial to think about such rare complications in terms of differential diagnosis and to initiate targeted diagnostics immediately so that an adequate therapy can be initiated timely.

**The pattern and outcome of pulmonary metastases from solitary fibrous tumor.**

ID: 987

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**Background:**

Solitary fibrous tumors (SFT) are rare mesenchymal tumors occurring in various anatomical sites including the thorax, retroperitoneum, and extremities. The clinical course of SFTs is almost benign; however, up to 35% of patients develop local recurrence, and/or distant metastasis. The pattern and outcome of pulmonary metastases from SFT has scarcely been examined.

**Materials and methods:**

A retrospective review of the medical and pathological records at the Departments of Thoracic Surgery and Plastic Surgery at the University Hospital Freiburg since 2010 was undertaken to identify the Patients treated for SFT. Patients were contacted by telephone and survival data were collected.

**Results:**

Of the 22 patients, 8 patients developed pulmonary metastasis (36.3 %). The median time to metastasis was 36.5 Months (IQR 6.75–60.5). A count of mitosis per 10 high-power fields (HPFs)  $\geq 4$  was observed in 100% of patients with pulmonary metastasis and only in 42.86% of patients with non-metastatic SFT ( $P = 0.018$ ). 5 patients underwent surgical resection of the pulmonary metastasis. The 3 years survival after resection of pulmonary metastases was 60%. The Median survival in patient with inoperable pulmonary metastasis was 8 months.

**Conclusion:**

The treatment of pulmonary metastasis of SFT is a special challenge due to the limited therapeutic options. In our case series a long-time survival could be achieved after surgical resection in selected patients.

## **Double splinting for rib fractures - a traditional technique applied experimentally**

ID: 1096

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### **Background:**

Among several techniques intramedullary splints are used for repair of rib fractures. So far these splints have not been used in the traditional technique of crossed K-wires.

### **Materials and methods:**

A sheep hemithorax was harvested with the sternum and spine. The hemithorax was cut in half resulting in two specimens of approximately 25 cm in width and 30 cm in length consisting of the upper and lower half of the hemithorax. Specimens were fixed in PMMA blocks and tested for stiffness and burst pressure of ribs using a Zwick Roell Z010 material testing machine. Pressure from the first step of the experiment was used to adjust for burst pressure of the upper half of the hemithorax. Rib fractures were then repaired with a single splint followed by repair in a double splint technique (crossed K-wire technique).

### **Results:**

Preparing half of a sheep hemithorax for fixation in PMMA blocks is feasible and allows for testing of stiffness and burst pressure. Repair with single intramedullary splints and double-splints (3 mm splints) in a crossed K-wire technique was feasible in the upper half of the hemithorax. The crossed K-wire technique resulted in a more stable repair demonstrated by load – distance curves and stiffness results.

### **Conclusion:**

Using a sheep hemithorax for testing of intramedullary splints for rib fracture repair is feasible using a quasi physiological setting with preservation of the anterior and posterior rib joints. The model has several limitations including the longitudinal oval shape compared to the human thorax. Secondly the intramedullary canal of sheep ribs is of small size only. Therefore repair with 3 mm size splints can be tested only. Machine testing of large specimen size is a challenge due to three dimensional configuration of the hemithorax, but nonetheless feasible. Fracture testing in this model allowed for a good estimate of rib fracture repair and handling of splints. The model is recommended for further testing in experimental and training settings.

## **Outcome of Emergency Lobectomy under Extracorporeal Membrane Oxygenation (ECMO) Support in Patients with severe COVID-19 Disease**

ID: 1108

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### **Background:**

Not much is known about the results of non-elective anatomical lung resections in COVID-19 patients put on ECMO. Aim of this study is to analyze the outcome of emergency lobectomy under ECMO support in patients with acute respiratory failure due to severe COVID-19 disease.

### **Materials and methods:**

All COVID-19 patients undergoing emergency anatomical lung resection with ECMO support at a German university hospital were included into a prospective database. The university hospital serves as only ECMO center for a population of approximately 2 million people in one of Germany's most severely affected regions. Study period was 01.04.2020 to 30.04.2021 (first, second and third wave in Germany). Patients characteristics, indications for surgery, clinical course and outcome were analyzed.

### **Results:**

A total of 9 patients (median age 61 years, IQR 10 years) were included. There was virtually no pre-existing comorbidity (Median Charlson Score of Comorbidity 0.2). The mean interval between first positive COVID test and surgery was 21.9 days. Clinical symptoms at the time of surgery were sepsis (9/9), respiratory failure (9/9), acute renal failure (5/9), pleural empyema (5/9), lung artery embolism (4/9) and pneumothorax (2/9). Mean ICU and ECMO days before surgery were 15.4 and 6, respectively.

Indications for surgery were bacterial superinfection with lung abscess formation and progressive septic shock (7/9) and abscess formation with massive pulmonary hemorrhage (2/9). All patients were under veno-venous ECMO with femoral-jugular configuration. Operative procedures were lobectomy (8) and pneumonectomy (1). Weaning from ECMO was successful in 4/9. In-hospital-mortality was 5/9. Mean total ECMO days were 10.3 ±6.2 and mean total ICU days 27.7 ±9.9. Mean lengths of stay was 28.7 ±8.8 days.

### **Conclusion:**

Emergency surgery under ECMO support seems to open up a perspective for surgical source control in COVID-19 patients with bacterial superinfection and localized pulmonary abscess. A multi-institutional research project is needed to obtain more evidence.

## **Long term survival and surgical treatment of lung cancer in Europe, an international registry study (LUCAEUROPE)**

ID: 612

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### **Background:**

LUCAEUROPE is a new research initiative aiming to study lung cancer outcomes in population-based cancer registries in European countries. Treatment for early-stage disease varies internationally due to different treatment policies. Besides surgery, stereotactic body radiation therapy was introduced as a standard of care for high-risk surgical patients. Large-scale studies of long-term survival and surgical treatment approach in Europe such as EUROCORE, which include most recent results from last results 1999-2007, or country analysis are outdated, with notable changes in incidence patterns and a remarkable improvement in survival over the last 17 years. Therefore, we evaluate early-stage NSCLC resection rates and survival stratified by UICC-Stage in several European national tumor registries.

### **Materials and Methods:**

Information on the patient treatment was derived from national European tumor registries (Denmark, Estonia, Slovenia, Germany, The Netherlands, and Belgium). To ensure compliance with respective national ethical and privacy regulations and the heterogeneity of the data sets, each dataset was separately analyzed by two local analysts according to a uniform protocol developed for this study. Extent of disease was recorded according to the 7th edition from January 2010 to December 2015. We study overall survival stratified by UICC stage and the association of surgical resection versus non-resection with demographic and clinical. For comparison with US data, we included SEER-data. The study protocol has been submitted and approved from the Ethics Committee of the Medical Faculty of Heidelberg.

### **Results:**

The national tumor registries of Sweden, Norway, Poland, Czech Republic, Austria, Bulgaria and Croatia did not fulfill the inclusion criteria of our research protocol. We are currently working on data transfer and data analysis with the registries of Denmark, Estonia, Slovenia, Germany, The Netherlands, and Belgium. The summarized results are currently discussed with all participating centers. The final version involving all partners will be agreed upon and presented.

### **Conclusion:**

LUCAEUROPE is a feasible research initiative aiming to monitor lung cancer outcomes in population-based cancer registries in Europe. The final version involving all partners will be agreed upon and presented in this congress.



## **Lung cancer resection after neoadjuvant immunochemotherapy versus chemotherapy in patients with synchronous oligometastatic non-small cell lung cancer**

ID: 918

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### **Background:**

Studies already demonstrated promising survival for locally treatment after neoadjuvant chemotherapy in patients with synchronous oligometastatic non-small cell lung cancer. The goal of this study was to compare the outcomes of lung cancer resection after neoadjuvant immunochemotherapy (IO+CTx) and neoadjuvant chemotherapy (CTx) in these patients.

### **Materials and methods:**

We retrospectively analyzed our patients treated with IO+CTx or CTx, locally treatment of the metastases and surgical resection of the primary tumor between 2017-2021. To compare the neoadjuvant treatments we defined two groups: Group A included patients treated with IO+CTx and Group B included patients treated with CTx. Descriptive statistical analyses were performed to analyze the characteristics of the patients, tumors, and short-term outcomes.

### **Results:**

In total 16 patients were included to the study, nine patients in Group A and seven patients Group B. In Group A all patients had a R0-resection, in Group B six patients had a R0-Resection and one patient a R1-resection of the primary cancer. There was no significant difference in preoperative Charlson comorbidity index ( $p= 0.608$ ) or ASA score ( $p= 0.077$ ) between the groups. The 30- day mortality rate in Group A and B were 0%.

33.3% of the patients treated with IO+CTx had a complete pathological response; the complete pathological and major pathological response in Group B were 42.9% and 14.2%, respectively.

The median follow-up time from initial diagnosis for Group A was 22 months (range: 10-35 months) and 26 months (range: 5-42) for Group B, respectively. All patients of the IO+CTx group are still alive, in contrast three patients of the CTx group died. Only two patients of Group A suffered from a local recurrence of a brain metastasis. There was no thoracic local recurrence or distant recurrence in Group A. In Group B there was no thoracic local recurrence, three local recurrences at the initial metastatic side and two distant metastases.

### **Conclusion:**

Altogether the study demonstrates the feasibility of lung cancer resection after neoadjuvant immunochemotherapy in patients with synchronous oligometastatic lung cancer. Although the number of included patients is small, the progression free survival and overall survival in patients after neoadjuvant immunochemotherapy might be promising compared to patients after neoadjuvant chemotherapy.