M U N I

COMMENTARY TO HABILITATION THESIS[1]

The presented habilitation thesis in Surgery is an annotated collection of previously published scholarly works dealing with advanced diagnostics and conservative and surgical treatment of lung cancer and predicting postoperative complications. Lung cancer was the most commonly diagnosed cancer worldwide in 2022.

The habilitation thesis comprises two primary sections. The first main part is theoretical (epidemiology, screening, diagnosis, TNM classification, therapy management, prognosis, and follow up of lung cancer) and summarizes the theoretical overview of the individual commented author's research in the experimental part. The second main part is experimental, devoted to the author's research. It is a collection of six published scholarly works.

The first publication, "Diagnostic and therapeutic management of pulmonary nodules," focused on the pulmonary nodules. As lung cancer screening programs are being introduced, the number of lung CT scans with detected pulmonary nodules will increase. Incorrect assessment may lead to overtreatment, delays in treatment, or failure to correct treatment, all of which can have negative consequences. This paper analyzes the key factors predicting nodule malignancy, patient's health profile, and risk factors. The recommendations of the Fleischner Society (FS), British Thoracic Society (BTS), and American College of Chest Physicians were summarized and compared in a review table. It also discusses the issue of ground-glass opacities and analyzes the benefits of using artificial intelligence in their diagnosis.

The second publication, "Subpleural pulmonary nodule marking with patent blue V dye prior to surgical resection." Subpleural lesions cannot be seen during surgery, making it challenging for the surgeon to accurately localize and remove them while ensuring a safe (tumor-free) margin using a minimally invasive approach that lacks tactile sensation. There exist many localization techniques, but none is optimal. We described the data of consecutive patients with pulmonary nodules located ≤ 30 mm from the parietal pleura who were indicated for VATS extra-anatomical resection between 2017 and 2023, which were retrospectively reviewed and analyzed. All patients underwent color marking of the area with the pulmonary lesion under CT-guided control immediately before the surgery. A total of 62 lesions were marked. The successful marking was observed in 56/62 (90.3%) patients. Our study confirmed that the procedure is a safe and effective method with minimal periprocedural complications. The results of this study contributed to the implementation of this technique in the diagnostic and therapeutic management of subpleural pulmonary nodules in our hospital. The question concerns the use of indocyanine green, which is more economically demanding.

The third publication, "Multiple lung cancers—case report and literature review," shows the problem of multiple primary lung cancers in both synchronous and metachronous forms. The incidence increases due to earlier diagnosis, more successful treatment at an early stage with prolonged survival

[1] The commentary must correspond to standard expectations in the field and must include a brief characteristic of the investigated matter, objectives of the work, employed methodologies, obtained results and, in case of co-authored works, a passage characterising the applicant’s contribution in terms of both quality and content.

of patients and thus prolonged the interval for the possibility of developing another primary lung tumor. Diagnosis is made difficult; metastatic disease must be excluded. Basic information is obtained from a biopsy of the tumor. In the early stage, the curative therapy is surgical resection; it could be challenging in the metachronous variant (after previous lobectomy).

The fourth publication is titled "Our experience with VV ECMO-assisted surgery—case report series." Veno-venous extracorporeal membrane oxygenation (VV ECMO) is a technique of extracorporeal support that facilitates blood gas exchange, enabling the complete replacement of lung function for a specified duration, such as during surgery. We presented our experience with elective and acute ECMO-assisted thoracic surgery (excluding lung transplantation and cardiac surgery). We collected data from 2/2019 to 11/2024, performing a total of 15 thoracic operations, including seven elective and eight emergency surgeries. There were no postoperative complications in elective surgeries. Acute surgery was complicated in five patients; three were indicated for acute surgical revision. The 30-day mortality rate for elective cases was 0%. In acute cases, the 30-day mortality rate was 37.5% (all patients died of complications related to ARDS). We verified in our case series that the rates of morbidity and death for carefully chosen patients undergoing elective surgery with VV ECMO assistance are extremely low. Patients with respiratory failure requiring surgical treatment may also benefit from VV ECMO. In this case, morbidity and postoperative mortality are high but related to the underlying disease. Its indication needs to be carefully assessed by a multidisciplinary team; clear recommendations are not established due to the small number of cases.

The fifth publication is "New models for prediction of postoperative pulmonary complications in lung resection candidates." The post hoc analysis included consecutive lung resection candidates. Two risk models were developed: the first used the resting end-tidal pressure of carbon dioxide, $PETCO_2$, (for patients with no available cardiopulmonary exercise stress testing, CPET), and the second used the ratio of minute ventilation to carbon dioxide production, the V_E/VCO_2 slope (for patients with available CPET). We used receiver operating characteristic analysis with the DeLong test and area under the curve (AUC) to compare the models. The dataset from 423 patients was randomly split into the derivation (n=310) and validation (n=113) cohorts. Two final models were developed, both including sex, thoracotomy, “atypical” resection, and forced expiratory volume in 1 s/forced vital capacity ratio as risk factors. In addition, the first model also included the rest of $PETCO_2$, while the second model used the V_E/VCO_2 slope from CPET. There were no differences in AUC between the derivation and validation cohorts. We created two multicomponent models/scores for postoperative pulmonary complication risk prediction, both having excellent predictive properties. We recommend incorporating the models into routine clinical practice.

The latest paper, "Hyperoxemia Post Thoracic Surgery—Does It Matter?" focuses on the issue of postoperative hyperoxemia and the incidence of postoperative pulmonary and cardiovascular complications during the first 30 postoperative days. Hyperoxemia was defined as an arterial partial pressure of oxygen (PaO_2) > 100 mmHg. Patients with sustained hyperoxemia at least two adjacent time points were considered hyperoxemic. PaO_2 was measured 1, 6, and 12 hours after surgery. A total of 363 consecutive patients were included in the study. The hyperoxemic group included 205 patients (57%) who were considered hyperoxemic. There was no significant difference in the incidence

of postoperative pulmonary and cardiovascular complications, length of stay in the intensive care unit, hospital stay, and 30-day mortality. Hyperoxemia seems to be harmless for the patient and therefore also unnecessary (does not affect postoperative complications). The evidence supports that FiO_2 should be titrated to maintain normoxemia in the postoperative period. However, we need further studies, preferably randomized controlled trials, to determine the optimal target oxygen level for the postoperative period.

In case of malignant or suspected lung cancer, an individual diagnostic and therapeutic plan is determined by a multidisciplinary team consisting of an oncologist, surgeon, radiotherapist, anesthesiologist, radiologist, and pulmonologist. The plan needs to align with the patient's overall health. The role of the surgeon within the multidisciplinary team is both diagnostic (biopsy and staging) and therapeutic (the physician directly performing the surgery). The surgeon has the final recommendation in determining the resect ability of the disease, the choice of surgical approach, and the consideration of postoperative risks. He or she must also be able to consider alternative, non-surgical treatment options and have a basic understanding of the above professions.

[1][2]

ČERVEŇÁK, V., ***Z. CHOVANEC *(corresponding author)****, A. BERKOVÁ, J. RESLER, T. HANSLÍK, M. KELBLOVÁ, K. NOVOSÁDOVÁ, V. WEISS, O. BÍLEK and J. VANÍČEK. Diagnostic-therapeutic management of pulmonary nodules; [Diagnosticko-terapeutický management plicních nodulů]. *Klinicka onkologie: casopis Ceske a Slovenske onkologicke spolecnosti* [online]. 2024, **39**(6), 408–418. ISSN 1802-5307. Available at: doi:10.48095/ccko2024408

Document Type: Review; Category: Oncology – SJR Q4 (data 2024)

Experimental work (%)	Supervision (%)	Manuscript (%)	Research direction (%)
50	50	50	50

[2]

CERVENAK, Vladimir, ***Zdenek CHOVANEC *(corresponding author)****, Alena BERKOVA, Petra CIMFLOVA, Martina KELBLOVA, Ivan CUNDRLE, Tomas HANSLIK, Jan RESLER, Lenka SOUCKOVA, Natalia JANKANICOVA and Jiri VANICEK. Subpleural pulmonary nodule marking with patent blue V dye prior to surgical resection. *Frontiers In Oncology*

[2] Bibliographic record of a published scientific result, which is part of the habilitation thesis.

[online]. 2024, **14**(1392398, Article 1392398). ISSN 2234-943X. Available at: doi:10.3389/fonc.2024.1392398

Document Type: Article; IF = 3,300; median IF ONCOLOGY – 2,800; Quartile by IF ONCOLOGY Q2; Quartile by AIS ONCOLOGY Q2

Experimental work (%)	Supervision (%)	Manuscript (%)	Research direction (%)
50	50	50	50

[3]

CHOVANEC, Z**. ***(corresponding author)*, I. ČAPOV, A. PEŠTÁI, M. BENEJ and M. PÁRAL. Multiple primary lung cancer - A case report and literature review; [Vícenásobné nádorové onemocnění plic kazuistika a přehled literatury]. *Klinicka Onkologie* [online]. 2016, **29**(4), 287–290. ISSN 0862-495X. Available at: doi:10.14735/amko2016287

Document Type: Article; Category: Oncology – SJR Q4

Experimental work (%)	Supervision (%)	Manuscript (%)	Research direction (%)
100	90	90	90

[4]

CHOVANEC, Z., A. PESTAL, A. BERKOVA, V. CERVENAK, I. PENKA and I. CUNDRLE. Our experience with VV ECMO-assisted surgery: case report series. *Anesteziologie A Intenzivni Medicina* [online]. 2025, **36**(1), 34–38. ISSN 1805-4412. Available at: doi:10.36290/aim.2025.001

Document Type: Article; IF = 0,1; median IF ANESTHESIOLOGY – 1,700; Quartile by IF ANESTHESIOLOGY Q4; Quartile by AIS ANESTHESIOLOGY Q4 (data in 2024)

Experimental work (%)	Supervision (%)	Manuscript (%)	Research direction (%)
50	50	50	50

[5]

SVOBODA, Michal, Ivan CUNDRLE JR, Marek PLUTINSKY, Pavel HOMOLKA, Ladislav MITAS, **Zdenek CHOVANEC**, Lyle J. OLSON and Kristian BRAT. New models for prediction of postoperative pulmonary complications in lung resection candidates. *Erj Open Research*

[online]. 2024, **10**(4, Article 00978-2023). ISSN 2312-0541. Available at: doi:10.1183/23120541.00978-2023

Document Type: Article; IF = 4,000; median IF RESPIRATORY SYSTEM – 2,300; Quartile by IF RESPIRATORY SYSTEM Q1; Quartile by AIS RESPIRATORY SYSTEM Q1

Experimental work (%)	Supervision (%)	Manuscript (%)	Research direction (%)
20	20	20	10

[6]

BRAT, Kristian, ***Zdenek CHOVANEC *(authors contributed equally to this work)****, Ladislav MITAS, Vladimir SRAMEK, Lyle J. OLSON and Ivan CUNDRLE JR. Hyperoxemia post thoracic surgery-Does it matter?. *Heliyon* [online]. 2023, **9**(6, Article e17606). ISSN 2405-8440. Available at: doi:10.1016/j.heliyon.2023.e17606

Document Type: Article; IF = 3,400; median IF MULTIDISCIPLINARY SCIENCES – 1,200; Quartile by IF MULTIDISCIPLINARY SCIENCES Q1; Quartile by AIS MULTIDISCIPLINARY SCIENCES Q2

Experimental work (%)	Supervision (%)	Manuscript (%)	Research direction (%)
50	50	50	50