
HRCT in Interstitial Lung Disease

Eva Kocova
Editor

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Instructive Case Studies

 Springer

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Volenti nihil impossibile
Nothing is impossible to him who
has the will

Foreword

I was pleased to read and, with several notes and recommendations, review the following text, which covers the radiological diagnostic aspects of lung disorders using HRCT within adults. Apart from the successful chapters of J. Polak, found in the first and second editions of Professor Vasakova's book on interstitial pulmonary diseases, this is a complete modern work of challenging problematics. Positive is the cooperation of the authors, as this book was created with the contributing work of radiologists and respiratory physicians from three important Czech institutes—University Hospital Hradec Králové, University Hospital Olomouc, and Thomayer Hospital. An important message that is illustrated throughout the whole text is the fact that today's diagnostic and decision-making process in patient care is based on consensual conclusions following a direct discussion within a multidisciplinary team consisting of a respiratory physician, a radiologist, and a pathologist.

I consider the curriculum of the book to be very successful in terms of meeting the main educational goal—increasing the knowledge for recognising basic abnormal images (morphs or patterns) and their use in clinical-radiological differential-diagnostic balances. In general, the clinical aspects of disease diagnosis are briefly analysed, and further, the basics of interpreting HRCT findings are sufficiently presented. I can see a special systematic approach in dividing the individual diseases according to the dominant patterns—decreasing density (cysts, emphysema, etc.) and increasing density (linear opacity, knots, shadowing of ground glass, and the consolidation of lung tissue). In this way, almost 50 cases are analysed in detail, all of which can be very well understood and practised. The book is aimed primarily at radiologists (I myself consider it the basic text for confirmation) and respiratory physicians, but it will also be appreciated by colleagues from other fields—pathologists, rheumatologists, other internists, immunologists, etc. It enjoys a great format and high-quality graphics, which is most convenient when recognising radiological findings in such rich images.

Congratulations to the primary author Eva Kocova MD, PhD, and to her other collaborators for a successful piece. Are you afraid of interpreting HRCT of the lungs? Do not buy a teddy bear, but start studying this book! In addition to all of

that, I hope you acquire a pleasant sentiment towards this field of imaging, which has a definite logic, starting already in the form of a secondary pulmonary lobule that can be controlled without fear!

Hradec Králové, Czech Republic
4 April 2018

Pavel Elias

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About the Authors

Vladimir Bartos, MD was born on 2 February 1976 in Hradec Králové. After he finished the grammar school in Nový Bydžov, he graduated from the Faculty of Medicine of Charles University in Hradec Králové in 2000. After graduation, he joined the Department of Pulmonology at the University Hospital in Hradec Králové, where he works until now. In 2004, he was certified in Internal Medicine and in 2007 in Pneumology and Phthisiology. In addition, he completed specialised training in bronchology and functional lung examination. Since 2006, he has been working as the head of ambulance, day-care centre, and functional laboratory of the Department of Pulmonology. He specialises in the care of patient on the long-term home oxygen therapy and also concentrates on patients with interstitial lung diseases. He works in bronchology and the functional lung lab. Since 2007, he has been working as an internal quality auditor at the University Hospital in Hradec Králové according to accreditation and certification of national standards of SAK CR.

He is a member of the Czech Pneumological and Phthiseological Society (member of the Functional Pulmonary Diagnostics Section, Interstitial Pulmonary Diseases Section, and the Lung Transplantation Section) and the European Respiratory Society. He is the coresearcher of several clinical studies and co-author of several publications and articles. His main professional interests are bronchology, functional lung examination, oxygen therapy, and interstitial lung diseases.

Filip Ctvrtlik, MD, PhD was born on 16 February 1975 in Olomouc. In 1989–1993, he studied at Jiri Wolker Grammar School in Prostějov. Due to his love for animals, he joined the University of Veterinary and Pharmaceutical Sciences Brno at the Faculty of Veterinary Hygiene and Ecology in 1993. However, in order to avoid the risk that he would eventually end up working in a slaughterhouse, he decided to fundamentally change his field. So, in 1994 and 1995, he worked as an educator at Don Bosco's Silesian Youth Center in Ostrava. In 1995–1997, he attended postgraduate studies at the Emanuel Pötting Post-Secondary Medical School in Olomouc, Department of Radiological Laboratory, and there his fascination for medicine grew. In 1997, he was admitted to the Faculty of Medicine of the Palacký University in Olomouc. He successfully completed his studies in 2003.

In 2003, he joined the Department of Internal Medicine III, Faculty Hospital, in Olomouc. In order to learn about the inner beauty of his patients, he decided to

devote himself to imaging methods, and in 2004, he joined the Department of Radiology of the Faculty Hospital in Olomouc, where he has been working as a secondary physician until now. In 2008, he defended his dissertation thesis on “Imaging Methods in the Diagnosis and Treatment of Adrenal Tumors”. In 2009, he successfully ended his residency in radiology and imaging methods. He is an assistant professor of undergraduate and postgraduate radiology teaching at the Faculty of Medicine and Dentistry of the Palacký University in Olomouc. He leads medical students in their scientific and professional activities and at the same time coordinates postgraduate studies. He is a member of the Czech Radiological Society and the American Roentgen Ray Society.

His specialisation is thoracic and urogenital radiology, where he closely cooperates with the Urological Clinic and especially with the Clinic of Pulmonary Diseases and Tuberculosis. He is the author of Czech and foreign publications, including publications with an impact factor.

He has an amazing wife, Liduska, and wonderful active children, Marketka, Honzik, and Hanicka.

Eva Kocova, MD, PhD was born in Bruntál on 1 November 1978. After graduating from high school, she was admitted to the Faculty of Medicine of Charles University in Hradec Králové. She successfully completed her studies in 2004. Before, she spent 3 months at the Mayo Clinic in Minnesota in Gastroenterology. After her studies, she started to work at the Department of Radiology of Chrudim Hospital. She gained specialised competences in radiology in 2011. In May 2012, she joined the Department of Radiology of the University Hospital Hradec Králové, where she concentrated on pulmonary and urgent radiology. In 2017, she completed her postgraduate studies. The topic of her dissertation was “Phenotype assessment of patients with a severe form of chronic obstructive pulmonary disease using HRCT of chest”. Her main field of professional interest is interstitial lung diseases. She attends a number of radiological and pulmonary congresses, where she often lectures as an invited speaker. She is the author and co-author of several publications in impact journals. She is a member of the Czech Radiological Society and European Society of Thoracic Imaging. Until 2019 she is ESTI DIPLOMA holder.

She is married and has two children. She likes to spend her free time with her family in the forests of Hradec Králové and in the Orlicke Mountains.

Vladimíra Lostakova, MD, PhD was born on 16 November 1959 in Dacice. Both parents were doctors. In 1978, she finished her grammar school final examinations in Olomouc and then studied at the Faculty of Medicine and Dentistry at the Palacký University in Olomouc. She graduated in 1984 and then joined the OUNZ Olomouc in 1985. In 1989, she obtained an attestation from Internal Medicine. In 1991, she joined the Department of Respiratory Medicine in the University Hospital in Olomouc, and in 1994, she obtained an accreditation in tuberculosis and respiratory diseases. As a pneumologist, she mainly deals with interstitial pulmonary diseases, pneumological cytology, and especially the evaluation of bronchoalveolar fluid with a focus on interstitial lung diseases. The topic of her doctoral study was the

importance of examining tumour markers CYFRA 21-1, NSE, TPA, and CEA in bronchoalveolar fluid in diffuse interstitial diseases.

She is a member of the Interstitial Lung Diseases Section. She also works as an assistant professor and participates in the teaching of students at the Faculty of Medicine and Dentistry of the Palacký University in Olomouc. She has two sons. Her older son graduated from the Faculty of Science, and her younger son is an orthopaedist who also works at the University Hospital in Olomouc. Her husband is an engineer-economist and works at the Regional Office in Olomouc. Her hobbies include classical music, theatre, cycling, and traveling. She is the author of a number of publications in the field of tuberculosis and respiratory diseases, particularly with a focus on interstitial lung diseases.

Martina Sterclova, MD, PhD was born in 1979 in Klatovy. She finished the grammar school in 1998, and then in 2004, she graduated at the Faculty of Medicine of Charles University in Hradec Králové. After graduation, she joined the Department of Respiratory Medicine of Thomayer Hospital, initially at a department in Prosečnice and then in Prague. In 2009, she passed her accreditation in the field of tuberculosis and respiratory diseases and defended her doctoral thesis on “Chemokines and their receptors in the pathogenesis of ILD”. Since 2008, she has been working as an assistant in the First Faculty of Medicine of Charles University in Prague and also participates in postgraduate education of the doctors, especially in the field of pneumology. She is a member of the Czech Pneumological and Phthiseological Society and the European Respiratory Society. She is also engaged in scientific activities, primarily with a focus on the pathogenesis of interstitial lung diseases. She regularly publishes in Czech and foreign professional journals and actively participates in Czech and international congresses.

Martina Vasakova, MD, PhD was born in Prague on 20 September 1964. She was the first child of a professor of mathematics and descriptive geometry and Tesla researcher in the field of television and shortwave broadcasting. She attended primary school with extended language learning at the Cuban Square in Prague. At the age of 13, she was admitted to Wilhelm Pieck Grammar School. She was expected to go to the renowned mathematical class, but she had chosen languages. In 1982, she passed the entrance examinations for the First Faculty of Medicine of Charles University. At that time, however, she was unsuccessful in her application due to what was then deemed to be a “politically incorrect political background”, but upon a ministerial appeal, she was accepted into the medical programme—from which she graduated in 1988. During her studies, she met her husband, Jaroslav, and gave birth to their first child, her daughter Tereška. At the age of 23, she joined the Research Institute of Tuberculosis and Respiratory Diseases (VÚTRN, later Department of Pneumology and Thoracic Surgery) in Bulovka, where she stayed until 1999. In 1990, she gave birth to her second child—son Jindřich. She obtained three postgraduate qualifications—the first one from Internal Medicine in 1992, the second qualification from the Institute of Tuberculosis and Respiratory Diseases in 1995, and the third one from Allergology and Clinical Immunology in 1999. She

was taught bronchology in VÚTRN by Frantisek Fiser and Jiri Patek. With Frantisek Fiser, she shared a medical room after arriving at VÚTRN. In 1993, she completed a bronchology course at The First Clinic of Tuberculosis and Respiratory Diseases, in Katerinska, under the supervision of Vasil Bohut, and later became the holder of a full license for interventional bronchology.

On 1 January 2000 (at the age of 36), she became the chief of the then newly established Institute of Pulmonary Diseases (now the Department of Respiratory Medicine of the First Faculty of Medicine of Charles University) of Thomayer Hospital, which was the head department in Prosečnice. In 2005, after a union between the departments in Prosečnice and Krc, she left her post in Prosečnice to take up the appointment of chief of the united main Department of Respiratory Medicine already based only in Krc. In 2016 onwards, she became the head of this department.

As part of further scientific education, she graduated in 2007 from a postgraduate study in the field of immunology at the First Faculty of Medicine of Charles University. In 2008, she remained in the field of internal medicine within the same faculty, and by 2015, she was appointed a professor in the same field.

Since the beginning of her career, she has also been involved in undergraduate and postgraduate education. In 1992–1996, she was an external assistant of the Third Faculty of Medicine of Charles University and in 1996–2000 a full assistant at the same faculty. In 2003–2008, she worked as an assistant professor at the First Faculty of Medicine of Charles University; in 2008, she started to work there as an associate professor and in May 2005 as a professor. She has been teaching and lecturing within postgraduate education for internists, pneumologists, and students of Nursing since 1999.

She is a tutor of PhD studies in the field of immunology at the First and Third Faculty of Medicine, human physiology and pathophysiology at the First Faculty of Medicine, and experimental surgery at the Third Faculty of Medicine and also an immunology tutor for master studies in the Science Faculty.

She is a member of the Czech Pneumological and Phthiseological Society (ČPFS), Czech Internist Society, Czech Immunological Society, Czech Society of Allergology and Clinical Immunology (ČSAKI), European Respiratory Society (ERS), American Thoracic Society (ATS), European Academy of Allergy and Clinical Immunology (EAACI), World Association of Sarcoidosis and Other Granulomatous Disorders (WASOG), and European Society for Tuberculosis (TB NET). In 2010, she was elected to the ČPFS Committee and became a coordinator of the field of pneumology and phthisiology for the Capital City of Prague. She is the chairwoman of the Interstitial Lung Disease Section of ČPFS. Within the EAACI, she was elected to the Asthma Section Board in 2017.

She is a researcher and coresearcher on a number of research projects focused on interstitial diseases and tuberculosis. She is also the coresearcher of international grants and research projects: RESOLVE, GenPhenReSa, IPF NET, Global IPF Collaborative Network, ERN, and CHILD-COST. She is a member of the Editorial Board of *Respirology* and *Studia Pneumologica et Phthiseologica*, editor of *BMC*

Pulmonary Medicine, and a reviewer for a several of the European and American journals. In 2016, she won the Czech Republic Innovation Award for the invention of a biodegradable tracheal stent.

She is the author of many Czech and foreign publications, including articles in journals with an impact factor, where mostly the articles that focused on genetics and the phenotype of interstitial lung diseases are repeatedly quoted. She lectures at domestic, foreign, and international pneumological and allergy congresses. She collaborates on creating textbooks for medical faculties and postgraduate education. Apart from her daily duties and tutoring, she is also involved in research project proposals and scientific cooperation with domestic and European scientific and clinical workplace. Her professional interests are interstitial lung diseases, immunology of lung diseases (asthma, interstitial lung diseases), and interventional bronchology.

In her personal life, she tries to spend her free time with her whole family and friends (including her cat named Daduska). Her main hobby is music and singing, especially rock and heavy metal. She graduated from a music school in piano and then classical guitar, but she does not have the time to play actively. She likes reading and going to the theatre and cinema. She likes concerts of classical and even non-classical music. She loves warm climates and the sea. She likes walking and running. She prefers to go on foot whenever it is possible. She practises yoga. In winter, she takes her husband skiing and skating.

P.S. She loves life with all its challenges and the adversities that it brings.

Jana Votrubova, MD, CSc was born in Prague. She graduated from the First Faculty of Medicine of Charles University in Prague in 1985. After graduation, she joined the Department of Internal Medicine of the Hospital in Vejprty, OÚNZ Chomutov, in the North Bohemian Region. After several years at OÚNZ Mlada Boleslav and NsP Kralupy nad Vltavou and OÚNZ Mělník, she returned to Prague to the Radiology Department of the First Faculty of Medicine of Charles University and the General Teaching Hospital. There she stayed for 10 years. In 2003, she started to work at the developing team of the first hybrid device in the Czech Republic at the Na Homolce Hospital, where she spent 5 years exclusively at PET/CT. After 5 years, she partially worked at magnetic resonance and partially at PET/CT. She was working abroad at the NHS Dumfries and Galloway for 2 years. In 1992, she received a first degree certificate in the field of radiodiagnostics and in 2006 a second degree certificate in the same field. She defended her candidacy work in 2001. Since 2012, she has been chief of the Department of Radiology of Thomayer Hospital in Prague. Her main areas of interest include oncological and oncosurgical radiodiagnostics. During her professional life, she participated in the first radiofrequency ablations of liver tumours in the Czech Republic and in particular in the introduction of the first PET/CT hybrid device in the Czech Republic.

She is a member of the Radiological Society of CLS JEP where she has been the vice-chair for 10 years. She is an active member of the European Society of Radiology and the European Society of Gastrointestinal and Abdominal Radiology.

She is the author of the monograph *Clinical PET and PET/CT* (Galen 2006) and co-author of several professional publications. A dozen times she lectured in the Czech Republic and abroad. She is the leading project executor of one grant and several clinical studies.

Monika Zurková, MD, PhD graduated from the Faculty of Medicine and Dentistry of the Palacký University in Olomouc, specialising in general medicine, in 1996. After graduating, she started to work at the Department of Respiratory Medicine at the University Hospital in Olomouc, where she works until now. She successfully obtained accreditations of the first degree from Internal Medicine in 1999, and in 2008, she received the Pneumology and Phthisiology certificate.

She has also graduated from specialised education in sleep medicine. She works as an assistant professor of general and dental medicine in the Czech and English study programmes. She is a lecturer of student scientific work. She defended her dissertation on the topic “Characteristics of Generalized Sarcoidosis” in 2015. She is the author of several clinical studies and professional articles and co-author of recommended procedures and publications. Her main professional interests are interstitial lung diseases and work in the sleep medicine laboratory. She is a member of the Czech Pneumological and Phthiseological Society, Interstitial Lung Diseases Section, and Czech Society for Sleep Research and Sleep Medicine.

Abbreviations

AFOP	Acute fibrinous and organising pneumonia
AIP	Acute interstitial pneumonia
AP	Angina pectoris
ARDS	Acute respiratory distress syndrome
ATS	American Thoracic Society
BAL	Bronchoalveolar lavage
COP	Cryptogenic organising pneumonia
COPD	Chronic obstructive pulmonary disease
CP	Cyclophosphamide
CPFE	Combined pulmonary fibrosis and emphysema
CT	Computed tomography
CTA	CT angiography
DAD	Diffuse alveolar damage
DAH	Diffuse alveolar haemorrhage
DIP	Desquamative interstitial pneumonia
DLco	Diffuse lung capacity for CO
DM	Diabetes mellitus
EAA	Exogenous allergic alveolitis
EBB	Endobronchial biopsy
EBUS	Endobronchial ultrasound
EBV	Epstein-Barr virus
EGPA	Eosinophilic granulomatosis with polyangiitis
ERS	European Respiratory Society
FEV ₁	Forced expiratory volume in one second
FVC	Forced vital capacity
GG	Ground glass
GGO	Ground glass opacity
HA	Heart action
HRCT	High-resolution computed tomography
ICD	Implantable cardioverter-defibrillator
ICS	Inhaled corticosteroids
IHD	Ischaemic heart disease
IL	Interleukin
ILD	Interstitial lung diseases

IAPF	Interstitial pneumonia with autoimmune features
IPF	Idiopathic pulmonary fibrosis
IRI	Immunoreactive insulin
K _{Co}	Transfer coefficient
LABA	Long-acting beta-agonists
LAM	Lymphangioleiomyomatosis
LE	Lower extremities
LIP	Lymphocytic interstitial pneumonia
LTOT	Long-term oxygen therapy
MDT	Multidisciplinary team
MEF50	Maximal expiratory flow at 50%
MI	Myocardial infarction
MIQ	Myocardial infarction Q type
MPR	Multiplanar reconstruction
MRI	Magnetic resonance imaging
NSIP	Non-specific interstitial pneumonia
OP	Organising pneumonia
PAP	Pulmonary alveolar proteinosis
PCR	Polymerase chain reaction
PLCH	Pulmonary Langerhans cell histiocytosis
PPFE	Pleuroparenchymal fibroelastosis
RB-ILD	Respiratory bronchiolitis-associated interstitial lung disease
Ref. v	Reference value
RTX	Rituximab
RV	Residual volume
SACE	Serum angiotensin-converting enzyme
SCTD	Systemic connective tissue diseases
SLE	Systemic lupus erythematosus
SMRP	Soluble mesothelin-related protein
SRIF	Smoking-related interstitial fibrosis
TB	Tuberculosis
TBB	Transbronchial biopsy
TBLB	Transbronchial lung biopsy
TIA	Transient ischaemic attack
Tiff.	Tiffeneau-Pinelli index FEV ₁ /VC
TLC	Total lung capacity
TNF	Tumour necrosis factor
UE	Upper extremities
UIP	Usual interstitial pneumonia
US	Ultrasound
VATS	Video-assisted thoracoscopic surgery
VC	Vital capacity