ESTI European Society of Thoracic Imaging

ESTI WINTER COURSE 2019

December 12-14, 2019

TROMSØ, NORWAY

FINAL PROGRAMME

WELCOME WORDS

Dear colleagues & friends,

Welcome to the second ESTI Winter Course!

The course programme will focus on elements from the level 3 chest radiology curriculum from the ESR. This includes diseases of the great vessels, infections, malignancies in pleura, mediastinum and lungs, interstitial lungs diseases, nodules management and lung cancer screening, intervention, trauma, PET-CT and MRI of the lungs.

The course is meant to help candidates interested in sitting for the ESTI diploma exam as well as serve as a solid repetition for experienced chest radiologists looking to refresh their knowledge in chest radiology.

This is the second time the ESTI is organising such a course and we are very excited about it. It has limited seats and there will be ample time for questions. We have added some case/quiz presentations, which will be interactive. We hope that this format will be educational and further the interest in chest/thoracic radiology in both, young and mature radiologists.

Welcome to Tromsø!

Anagha P. Parkar
ESTI Winter Course 2019 Organiser

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ESTI WINTER COURSE 2019 FACULTY

Galit Aviram, Tel-Aviv/IL
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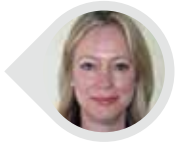
Anastasia Oikonomou, Toronto/CA
Simon Padley, London/UK
Anagha P. Parkar, Bergen/NO
Mathias Prokop, Nijmegen/NL
Marie-Pierre Revel, Paris/FR
Cornelia Schaefer-Prokop, Amersfoort/NL
Joachim Wildberger, Maastricht/NL

GALIT AVIRAM

- Graduated from Sackler School of Medicine, Tel-Aviv, Israel
- Clinical fellowships in Chest Imaging, University of Western Ontario Canada, and Cardiothoracic Imaging, University of Miami
- Published 95 articles in peer reviewed scientific journals, 65 original articles, 30 review or case reports
- Professor of Diagnostic Radiology, Tel Aviv University Sackler School of Medicine
- Member editorial boards of CHEST (2012-2019), and of The Journal of Thoracic Imaging, section editor of "Venous Thromboembolism" (2010-to date)
- Head of Cardiothoracic Imaging Unit in Tel-Aviv Sourasky Medical Center

SUE COPLEY



Sue Copley was appointed Consultant Radiologist at Imperial College NHS Trust London in 2001 and Reader in Thoracic Imaging, Imperial College, London in 2008. She is an author of over 50 peer reviewed papers, 12 book chapters and 2 textbooks. She is an Editorial Board Member for Clinical Radiology and reviews for several European and North American Journals. She is the past President of the British Society of Thoracic Imaging (BSTI) (2014-2017) and previous General Secretary of ESTI (2015-2016). Research interests include benign asbestos-induced pleuroparenchymal disease, effects of ageing and obesity on the lung.

Education and Training
MB.BS (London) 1990
Member of the Royal College of Physicians (MRCP) 1994
Fellow of the Royal College of Radiologists (FRCR) 1997
MD (University of London) 2000
Fellow of the Royal College of Physicians (FRCP) 2009

SUJAL DESAI

Professor Desai trained in medicine at the Middlesex Hospital Medical School in London, qualifying in 1987. As senior house officer, Professor Desai spent time at Royal Brompton Hospital and, after completing the MRCP (UK), he entered formal radiology training at King's College Hospital Medical School. He was awarded the Frank Doyle Medal for achievement in the Part I FRCR examination and the Rohan Williams Medal for the Part II FRCR examination.
Following core radiology training Professor Desai undertook research at Royal Brompton Hospital, under the supervision of Professor David Hansell (his predecessor in the post he now holds), being awarded an MD for his thesis on structural-functional correlations in fibrosing lung disease. Professor Desai was previously a consultant at King's College Hospital in London where he worked for 18 years before returning to Royal Brompton Hospital.

FERGUS GLEESON

Professor Fergus Gleeson is a Consultant Radiologist and Professor of Radiology in Oxford. He trained in Cambridge, Papworth and London, and was a Fellow in Radiology at UCLA in America. He was appointed to Oxford in 1992, is Head of Academic Radiology in Oxford, running the ACF and PhD programme, and is the Director of the Oxford Radiology Research Unit at Oxford University Hospitals NHS Foundation Trust. He has published over 200 peer review papers and book chapters, has a h-index of 62, and has more than £20 million in grant income.
His specialist interests are in Artificial Intelligence, Thoracic Imaging, PET-CT and Hyperpolarized xenon MRI. Fergus is also the Chief Medical Officer of the National Consortium of Intelligent Medical Imaging (NCIMI): which aims to bring together the NHS, and University and industry partners to promote the development and implementation of artificial intelligence in medicine.

FRANCESCO MOLINARI

Consultant radiologist (attendant) and head of department of radiology at the Hospital of Tourcoing, France, with 17 years of professional clinical activity as radiologist, and MRI research fellowships in Germany (German National Cancer Institute, DKFZ) and USA (Beth Israel Deaconess Medical Center, Boston). Special field of research and clinical interest in diagnostic imaging.

ANASTASIA OIKONOMOU

Dr. Anastasia Oikonomou completed medical school and diagnostic radiology residency in Aristoteles University of Thessaloniki, Greece and completed her PhD in Democritus s University of Thrace. She pursued fellowships in thoracic imaging in London, UK and in Ottawa and Vancouver, Canada. She completed a cardiac imaging fellowship later in Ottawa, Canada. After working for 10 years in Democritus University of Thrace, Greece she moved to Toronto where she is currently working as a Staff Cardiothoracic radiologist in the Medical Imaging Department in Sunnybrook Health Sciences Centre where she is appointed the Head of the Cardiothoracic Division. She is an Associate Professor at the University of Toronto.

SIMON PADLEY

Professor of Practice, Diagnostic and Interventional Radiology, Imperial College London.
Consultant Radiologist, Director of Radiology, Royal Brompton Hospital, London.

Current practice

My current clinical radiological practice primarily consists of cardiac and thoracic imaging and image guided intervention.
Since becoming a consultant in 1994 I have been invited to teach and speak at national and international meetings on many occasions. I supervise ICSM undergraduate BSc and postgraduate MD students who undertake department based research projects.

I have published more than 130 peer reviewed articles and 100 Scientific Abstracts as well as 40 book chapters and 1 book. My h-index is 40.0, i10 index 87 and I have been cited more than 5000 times.
Current research interests are centred on application of CT and MRI for assessment and monitoring of patients with lifelong respiratory conditions as well as new and evolving interventional techniques in thoracic disease.
Level 3 certified in Cardiac CT (BSCI).

Membership of professional bodies

British Institute of Radiology, Royal College of Radiologists, Radiological Society of North America, British Society of Chest Radiologists, European Society of Thoracic Imaging, British Society of Interventional Radiology, British Society of Cardiac Imaging.

ANAGHA P. PARKAR

Dr. Angha P. Parkar is a general radiologist with a special interest in thoracic, cardiac and musculoskeletal imaging, currently working in the Haraldsplass Deaconess Hospital in Bergen, Norway. She is also the secretary of ESTI and an active member of the ESSR and the ESR contributing on various boards and subcommittees.

MATHIAS PROKOP

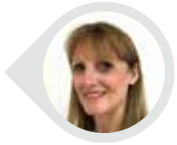
Mathias Prokop is Professor of Radiology at Radboud University Nijmegen and chairman of the Department of Radiology and Nuclear Medicine. He came to the Netherlands in 2002 when he was appointed Professor of Radiology at UMC Utrecht in 2004. From 1998 he had been working as an associate professor of radiology at the University of Vienna Medical School, Austria. He trained as a radiologist at Hanover Medical School, Germany and earned a Bachelor of Science in Physics at Philipps-University Marburg, Germany.

Prof. Prokop is an expert in body imaging with a special focus on multislice CT and new imaging technologies. As one of the first users of the various generations of multislice CT scanners, he is working on new and improved imaging applications. In the past decade he had concentrating on chest screening with CT. He is currently focusing on high-resolution CT perfusion imaging.

The author of more than 350 articles in peer-reviewed scientific journals, 50 book chapters, and 500 invited lectures, Prof. Prokop has published a textbook on body computed tomography that shas been translated into 5 languages. Prof. Prokop served on several industry advisory boards as well as various scientific committees, most recently the European Society of Radiology (ESR). He has been consultant to the International Atomic Energy Agency for radiation protection in CT and to the WHO for individual health assessment. He was vice chairman of the Dutch Radiological Society and he has received several awards from leading radiological societies including the Radiological Society of North America (RSNA) and the German Roentgen Society. He is a Fellow of the Society of Body CT and Magnetic Resonance (SBCTMR), member of the Fleischner Society and honorary member of the Hungarian Society of Radiology.

His department is now working on technical breakthroughs in the fields of computer-aided diagnosis, robot-assisted interventions, as well functional image analysis including MR spectroscopy, perfusion imaging with MR and CT, and molecular imaging agents for lymph node diagnostics. The ultimate goal is to make healthcare more affordable by increasing precision and automation of diagnostic and therapeutic procedures, thus freeing manpower for those areas in which the "human touch" is most needed.

MARIE-PIERRE REVEL



Marie-Pierre Revel is currently Full Professor of Radiology at Cochin hospital, in charge of the Cardiothoracic Imaging unit. She is the past president of the European Society of Thoracic Imaging and has an internationally recognized expertise in thoracic imaging. She has been developing a new approach for lung nodule evaluation based on volumetry for estimating the volume doubling time of indeterminate lung nodules, a strategy which has been adopted in the European studies on lung cancer screening. She has been involved in the French lung cancer screening study DEPISCAN.
She is the responsible person for the lung cancer screening certification project of the European society of radiology, a specific programme which has been established to train European radiologists for lung cancer screening. Her field of interest also includes the relation between thrombo embolism and cancer.

Field of Expertise: Thoracic Imaging – Lung nodule volumetry – Lung Cancer Screening

Research Topic: Computer vision – Artificial intelligence

CORNELIA SCHAEFER-PROKOP

Cornelia Schaefer-Prokop received her professor of Radiology at Hannover Medical School, Germany in 2007. She works at Meander Medical Centre in Amersfoort, and at Radboud University Nijmegen, the Netherlands.

Cornelia Schaefer-Prokop was born in Essen, Germany. She received her radiology training from 1987 to 1993 in Germany. From 1988 to 89 she worked as a research fellow in Chest Radiology at Harvard Medical School, Boston. After having worked for 6 years at the General Hospital of Vienna, she moved in 2004 to the Netherlands.

She is known for her research in Chest Radiology covering the areas of digital radiography, computer-aided diagnosis in CT and radiography, high resolution CT of interstitial lung diseases and classification and malignancy risk assessment of pulmonary nodules. She is editorial board member of Radiology and European Radiology. She is author of > 160 articles in peer reviewed journals and more than 40 book chapters and is co-editor or editor of 3 books (Computed Tomography of the Body Critical Care Radiology and the 6th edition of the Grainger & Allison).

Cornelia Schaefer-Prokop has given more than 200 invited lectures at international conferences and postgraduate teaching courses including the ECR, RSNA, ERS and the IDKD. In 2009 she has been appointed member of the Fleischner Society, she was president of the European Society of Thoracic Imaging (ESTI) in 2013/2014 and will be president of the Fleischner Society in 2022.

JOACHIM WILDBERGER

Joachim Ernst Wildberger is full Professor of Radiology and Chairman of the Department of Radiology and Nuclear Medicine at Maastricht University Medical Center (MUMC+), the Netherlands. In addition, he serves as Director of the Division of Clinical Imaging and Diagnostic Laboratories at MUMC+.
Graduated at the Rhenian-Westphalian Technical University (RWTH) in Aachen, Germany, he received his medical degree in 1994 from RWTH. After internships in Cardiology and Diagnostic Radiology (Mönchengladbach/Leipzig), he started his residency in Diagnostic Radiology at the University Hospital Aachen.

He was board certified for Diagnostic Radiology in December 1998 and became a fellow/staff member at this department thereafter. He received his Ph.D. in Radiology in 2002, was appointed as vice-chairman of the department in 2006 and received a professorship at the RWTH Aachen in 2007. In July 2007 he became Head of Department, Diagnostic Radiology, HELIOS Klinikum Berlin-Buch, Charité Berlin, Campus Buch, Germany, before moving to his present position.

He is author and co-author of ~400 scientific papers in peer-reviewed international journals. His main research topics are technical developments and functional imaging in computed tomography, contrast media research, cardiac imaging as well as image-guided interventions.

PROGRAMME OVERVIEW

THURSDAY, DECEMBER 12

12:00-12:30	Welcome Lunch
12:30-13:55	**Session 1: Vessels** *Moderator: A.P. Parkar, Bergen/NO*
12:30	Welcome *A.P. Parkar, Bergen/NO*
12:35	Pulmonary embolism, pulmonary hypertension *G. Aviram, Tel Aviv/IL*
13:00	Imaging in Hemoptysis *S. Padley, London/UK*
13:30	Acute aortic syndrome *G. Aviram, Tel Aviv/IL*
13:55-14:20	Break
14:20-15:20	**Industry sponsored symposium**
14:20	Recent advances in Chest CT *M. Lell, Nuremberg/DE*
14:50	Innovations along the workflow for Chest CT imaging *J. Merz, Forchheim/DE*
15:20-15:30	Break
15:30-16:25	**Session 2: Trauma and intervention** *Moderator: J. Wildberger, Maastricht/NL*
15:30	Thoracic interventions tips and tricks, incl. ablation *J. Wildberger, Maastricht/NL*
15:55	Thoracic trauma imaging *A. Oikonomou, Toronto/CA*
16:25-16:45	Coffee Break
16:45-18:10	**Session 3: MRI/Quiz** *Moderator: J. Wildberger, Maastricht/NL*
16:45	MRI of the lungs *A. Oikonomou, Toronto/CA*
17:10	Cystic and cavitary lung lesions *A.P. Parkar, Bergen/NO*
17:40	Quiz cases *J. Wildberger, Maastricht/NL*

FRIDAY, DECEMBER 13

08:30-10:30 **Session 4: Neoplasms**
Moderator: A.P. Parkar, Bergen/NO

08:30 Pleural neoplasms
F. Gleeson, Oxford/UK

08:55 Mediastinal tumors
M-P. Revel, Paris/FR

09:25-09:35 Break

09:35 Lung cancer staging
C. Schaefer-Prokop, Amersfoort/NL

10:05 PET/CT evaluation lungs
M. Prokop, Nijmegen/NL

10:30-10:50 Coffee Break

10:50-12:00 **Session 5: Lung cancer, AI, Screening**
Moderator: F. Gleeson, Oxford/UK

10:50 Imaging evaluation after immunetherapy
M-P. Revel, Paris/FR

11:15 Artificial intelligence in chest radiology
F. Gleeson, Oxford/UK

11:40 Lung cancer screening, nodule management
M. Prokop, Nijmegen/NL

12:00-12:10 Break

12:10-13:10 **Industry sponsored lunch symposium „ILD – As seen by a pulmonologist“**
Tomas Eagan, pulmonologist, Haukeland University Hospital & Professor University of Bergen

13:10-14:00 Lunch Break

14:00-15:30 **Session 6: COPD, Pneumoconioses**
Moderator: S. Copley, London/UK

14:00 Imaging COPD
S. Padley, London/UK

14:30 Imaging of Pulmonary Vasculopathies
S. Copley, London/UK

15:00 Pneumoconioses
F. Molinari, Lille/FR

15:30-16:00 Coffee Break

16:00-17:30 **Session 7: Airways disease**
Moderator: A.P. Parkar, Bergen/NO

16:00 CT of small airways
S. Copley, London/UK

16:30 CT of trachea and large airways
M. Prokop, Nijmegen/NL

17:00 Normal variants on HRCT
S. Copley, London/UK

SATURDAY, DECEMBER 14

08:30-10:45	**Session 8: HRCT and ILD** *Moderator: F. Molinari, Lille/FR*
08:30	Patterns on HRCT *F. Molinari, Lille/FR*
09:00	Drug induced pulmonary disease *C. Schaefer-Prokop, Amersfoort/NL*
09:30-09:45	Break
09:45	Cases from ILD MDTs *S. Desai, London/UK*
10:15	Sarcoidosis and granulomatous disease *S. Desai, London/UK*
10:45-11:15	Coffee Break
11:15-12:45	**Session 9: ILD part II, cavitary lung lesions** *Moderator: A.P. Parkar, Bergen/NO*
11:15	Quiz cases *A.P. Parkar, Bergen/NO*
11:45	Information about Diploma and LCS project *A.P. Parkar, Bergen/NO*
12:05	Information about ESTI 2020 Oxford *F. Gleeson, Oxford/UK*
12:15	Pick up of certificate of attendance & farewell
12:45-13:45	Farewell Lunch

ABSTRACT SYLLABUS

PULMONARY EMBOLISM, PULMONARY HYPERTENSION

G. Aviram, Tel Aviv/IL

Description

Acute pulmonary embolism (PE) is a common, potentially fatal disease. As Its incidence significantly increases with aging, even higher incidence rates are expected in the future. PE often presents with nonspecific symptoms of dyspnea and chest pain, and thus imaging plays a paramount role in its diagnosis.

CT pulmonary angiography (CTPA) is currently the modality of choice for acute PE diagnosis. Optimization of the CTPA protocol allows reduction of contrast and radiation doses without reducing its high accuracy. CTPA can also contribute to immediate risk stratification and management decisions by revealing findings which are consistent with right ventricular dysfunction.

Another cause of exertional dyspnea, which is associated with an increased morbidity and mortality, is pulmonary hypertension (PH). PH encompasses a large variety of diseases and is classified into five World Health Organization (WHO) groups according to clinical presentation, pathological findings, hemodynamic characteristics, and treatment strategy. Broadly, PH can be thought of as from "pre-capillary" or "capillary" abnormalities of pulmonary vasculature (WHO groups 1,3,4,5) or being from "post-capillary" from left heart disease (WHO group 2), which is believed to be the most common cause of PH, given the high prevalence of left heart disease. Common CT signs of PH include dilatation of the pulmonary trunk, enlargement of the right heart chambers, reflux of contrast to the inferior vena cava and the hepatic vein and mosaic perfusion of the lung parenchyma. Treatment strategies vary greatly in relation to PH etiology, hence, advancing knowledge on the specific imaging characteristics of the various PH groups can contribute to PH classification and patient management.

Learning objectives

- To present the optimized CT pulmonary angiography protocol.
- To illustrate the imaging findings and risk assessment parameters in acute PE.
- To illustrate the CTPA signs of pulmonary hypertension
- To discuss the difference of CTPA findings in acute PE vs. chronic PE
- To describe characteristic findings associated with other causes of pulmonary hypertension

IMAGING IN HEMOPTYSIS

S. Padley, London/UK

Description

Haemoptysis may be a medical emergency. There is no clear consensus on the volume of blood required to meet the criteria for massive haemoptysis. Current CF guidelines have adopted the definition outlined below:

Scant < 5ml
Mild–Moderate 5–240 ml
Massive > 240 ml

Massive haemoptysis may be more usefully defined as haemoptysis which is life-threatening either due to the subsequent risk of exsanguination or airway obstruction. Clinical manifestations of massive haemoptysis may include the requirement for transfusion, hospitalisation, intubation, aspiration of blood to the contralateral lung, airway obstruction, hypoxemia requiring mechanical ventilation and death. A gurgling sensation on one side of the chest may be a helpful way of clinically lateralising the bleeding in massive haemoptysis.

Patients with CF who suffer from scant haemoptysis may not require investigation and treatment, especially if it is normal for the patient to cough up small amounts of blood

Massive haemoptysis is more likely to occur in patients with poor lung function. The lifetime prevalence of massive haemoptysis in CF is 4.1%. Bleeding tends to originate from tortuous bronchial arteries and may be secondary to acute-on-chronic airway inflammation. All patients with massive haemoptysis should be admitted to hospital for observation for further haemoptysis and treatment with antibiotics.

Most patients with haemoptysis will improve with cessation of bleeding with supportive treatment. Patients who are refractory to the above therapy, or who experience recurrent bleeding (> 100 ml / day for 3 of 7 consecutive days) may be managed with:

1. Intravenous terlipressin 2 mg STAT followed by 1-2mg every 4-6 hours until the bleeding stops or 72 hours has elapsed since onset of the bleed. Argipressin is an alternative to Terlipressin.
2. Bronchial artery embolization.
3. Bronchoscopic evaluation is not generally recommended in CF patients prior to embolisation in those who are not intubated.
4. Non-invasvie ventilation is not recommended in patients with massive haemoptysis.
5. Lung resection may be considered CF patients with massive haemoptysis who have failed to respond to bronchial artery embolization.

Bronchial artery embolization

1. Bronchial artery angiography should be carried out by experienced operators with the primary aim of identifying the causative bleeding vessel. If positive identification of the bleeding vessel is not possible (as is usually the case), then any large bronchial or systemic collateral vessels should be embolised to stasis.
2. Before embolization is undertaken CT angiography should be considered. This provides an accurate roadmap of possible embolization targets, including bronchial arteries and vessels arising for the head and neck branches and the abdominal aorta (phrenic arteries).
3. If the patient is too unstable to undego a new CT then any prior CT imaging should be reviewed for target vessel identification.
4. Patients will be be asked to give consent after the risks of the procedure have been discussed, including stroke, paralysis (<<0.1%), chest pain, dysphagia and puncture site complications.

Learning objectives

- To know the classification of vasculitis
- To recognize the main CT abnormalities observed in the lung, large vessels and/or airways
- To know the differentials of pulmonary involvement

ACUTE AORTIC SYNDROME

G. Aviram, Tel Aviv/IL

Description

Acute aortic syndrome (AAS) is a potentially fatal pathologic process originating from injury of the intima and medial layers of the aorta. Classically it includes acute aortic dissection, intramural hematoma, and penetrating atherosclerotic ulcer. These entities should be viewed as different points on a spectrum and may occur in isolation or concurrently. AAS is relatively uncommon condition, which should be considered and diagnosed promptly in patients presenting with acute chest or back pain and high blood pressure. Efficient diagnosis of these entities significantly influences prognosis and guides therapy, with contrast-enhanced computed tomography angiography (CTA) being the most rapid and robust imaging technique. Electrocardiographic gating further improves diagnostic precision of CTA especially for the aortic root and the ascending aorta.

Due to its simplicity and correlation with clinical management the Stanford classification of AAS is used more widely. Stanford type A aortic syndrome involves the ascending aorta and may extend to the distal aortic arch or descending aorta. It typically is treated by immediate open surgical procedure given the high mortality (26%-58%) and proximity to the aortic valve and great vessels (with potential for complications such as tamponade). The Stanford type B involves the aorta distal to the brachiocephalic arteries and usually is managed medically. Complications of type B aortic dissection occur in approximately one-third of patients, necessitating intervention, with thoracic endovascular aortic repair (TEVAR) being the preferred procedure.

Learning objectives

- To present the current background, definition and classification of the spectrum of acute aortic syndrome.
- To illustrate the characteristics CT findings seen in patients with acute aortic syndrome.
- To suggest the most suitable CTA and ECG-gated CTA techniques for accurate diagnosis and effective management of patients with acute aortic syndrome.

THORACIC INTERVENTIONS TIPS AND TRICKS, INCL. ABLATION

J. Wildberger, Maastricht/NL

Description

Image-guided interventions for diagnostic and therapeutic purposes are widely performed. Patient inclusion and exclusion is probably the most crucial part of the entire procedure. Opportunities and potential drawbacks of the anticipated technique should be reflected so that the individual decision can be put on a firm footing (central question: Is there enough evidence in order to allow for a clear-cut indication management that meets objective criteria?). The mandate for interventional treatment should ideally be based on consensus (e.g. by an internal review board); in terms of tumor therapy from a certified (quality accredited) cancer center. Treatment may be curative, but it is more likely to form part of a palliative treatment regime.

Learning objectives

- To consider relevant and fundamental questions in the forefront of the intervention.
- To understand how to perform image-guided thoracic interventions.
- To become familiar with different types of ablative techniques, incl. RFA.
- To learn how to avoid complications, and how to treat them, if applicable.
- To reflect on the outcome of the interventional procedure.

THORACIC TRAUMA IMAGING

A. Oikonomou, Toronto/CA

Objectives

Thoracic injury overall is the third most common cause of trauma following injury to the head and extremities. More specifically, penetrating thoracic injury is the cause of 4-15% of admission to major trauma centres. Blunt and penetrating thoracic trauma has a high morbidity and mortality accounting for approximately 25% of trauma-related deaths, second only to head trauma. More than 70% of cases of blunt thoracic trauma are due to motor vehicle collisions with the remaining caused by falls or blows from blunt objects. Penetrating thoracic injury is mainly caused by knives and handgun bullets. Mechanisms of injury are discussed and spectrum of abnormalities and radiologic findings encountered in blunt and penetrating thoracic trauma are categorized in injuries of pleural space (pneumothorax, hemothorax), lungs (pulmonary contusion, laceration, herniation), airways (tracheobronchial lacerations, Macklin effect), esophagus, heart, aorta and great vessels, diaphragm and chest wall (rib, scapular, sternal fractures and sternoclavicular dislocations). The possible coexistence of multiple types of injury in a single patient is stressed and therefore systematic exclusion after thorough investigation of all types of injury is warranted. Chest radiography plays an important role in the initial emergency work-up of the chest trauma patient, facilitating detection of tension pneumothorax, large-volume haemothorax, flail chest, or malpositioned instrumentation. Multidetector computed tomography (MDCT) has, however, established itself as the preferred imaging method for the evaluation of polytrauma patients allowing for significantly reduced scanning times to a few seconds allowing more time for post-diagnosis appropriate care. Finally, high-quality multiplanar and volumetric reformatted CT images greatly improve detection of injury and enhance the understanding of mechanisms of trauma-related abnormalities.

Learning objectives

- To discuss epidemiology, mortality - morbidity, significance, pathophysiologic features and mechanisms of injury in blunt chest trauma
- To discuss the typical radiologic findings as well as pitfalls associated with the wide spectrum of types of injury in the thorax, including injury of the lung parenchyma, trachea and airways, aorta (and aortic vessels), heart and pericardium, esophagus, pleura, diaphragm and thoracic wall. Possible coexistence of multiple types of injury is stressed
- To review the advantages and diagnostic impact of CT/MDCT for selected injuries over other modalities and discuss recommended imaging protocols and algorithms

MRI OF THE LUNGS

A. Oikonomou, Toronto/CA

Description

MRI of the lungs has undergone the last fifteen years ground-breaking technological developments.

Undoubtedly the biggest advantage of MRI has been the lack of ionizing radiation offering an alternative diagnostic modality to extreme ages such as women at child-bearing age and pediatric patients as well as in patients with allergy to iodinated contrast medium.

With major technological advances related to fast sequence and parallel imaging, gating and signal enhancement MRI has gained the unique ability of assessing lung function in addition to higher resolution of morphologic and anatomic imaging.

MRI has classically been the mainstay in the management of superior sulcus tumors, tumors where chest wall invasion is suspected and for further characterization of mediastinal tumors and pleural mesothelioma.

However, MRI is increasingly gaining recognition in clinical practice in fields where CT used to be unbeatable such as diagnosis of pulmonary embolism, pulmonary arterial hypertension, staging of lung cancer, detection of early lung cancer and small pulmonary nodules, emphysema and airways disease such as cystic fibrosis.

Learning objectives

- To review the main clinical indications for which thoracic MRI is widely used
- To review the clinical indications and MRI findings for which thoracic MRI is increasingly used such as pulmonary embolism, lung cancer staging, detection of early lung cancer, emphysema and cystic fibrosis
- To review basic clinical MRI protocols for the most common clinical indications
- To understand the persisting limitations of thoracic MRI and anticipated future progress

CYSTIC AND CAVITARY LUNG LESIONS

A.P. Parkar, Bergen/NO

Description

Pulmonary cystic and cavitary lesions encompass many different differential diagnoses, from acute infections, to chronic diseases and malignancies.

A cavity is a gas filled space, seen as a lucency or low attenuation are, within a pulmonary consolidation, mass or nodule. The wall thickness may vary considerably. There is a continuous transition from cavities to cysts. Cysts are usually thin walled (.e. <2mm). A wall thickness <7mm is highly specific for benign disease, and >24mm specific for malignant disease, however, none are absolute, as thin walled malignancies do occur.

Common cystic diseases include LAM, LCH, LIP, whereas one may also encounter rarer entities such as Birt Hogg Dube in clinical practice.

In differentiating malignant from benign entities in cavities, type of content is unhelpful. The location of lesions is sometimes helpful to exclude certain differentials. The clinical symptoms are unhelpful, as acute onset may be seen in both malignant and non malignant entities. The combination of symptoms, laboratory results, past clinical history and imaging findings (wall thickness, contrast enhancement, location of lesions and singularity or multiplicity) lead to narrowing down the lists of differentials.

Learning objectives

- To review the diagnostic criteria and differentials of cystic and cavitary lung lesions
- To understand the algorithmic approach that can be used to narrow the differentials

QUIZ CASES

J. Wildberger, Maastricht/NL

Description

Together with my colleague, Dr. Hester van Piggelen-Gietema, I will present quiz cases from our daily practice in Maastricht. Furthermore, we will also test the knowledge of the attendees in the category “around town”.

The winners will receive a small price – don’t miss it! We are looking forward to it, it will be fun.

PLEURAL NEOPLASMS

F. Gleeson, Oxford/UK

Description

Pleural disease may present clinically with pain or shortness of breath, or be discovered incidentally. The diseases involved may be benign or malignant. The first examination performed is usually the CXR, but ultrasound, CT, PET-CT and MRI may also be used to determine the aetiology and significance of the disease demonstrated on CXR.These different imaging tests help not only to determine whether the disease is benign or malignant, but also the best sites for biopsy and to stage primary malignant pleural disease, malignant mesothelioma. This presentation will discuss the different imaging manifestations of benign and malignant disease and their different imaging appearances.

Learning objective

- To learn about the different imaging manifestations of benign and malignant pleural disease
- To appreciate the role of CT, MRI and PET-CT in distinguishing benign from malignant disease
- To become familiar with staging malignant pleural disease

MEDIASTINAL TUMORS

M-P. Revel, Paris/FR

Description

The International Thymic Malignancy Interest Group (ITMIG) has proposed a 3-compartment model of the mediastinum distinguishing prevascular (anterior), visceral (middle), and paravertebral (posterior) compartments, with anatomic boundaries defined clearly by computed tomography. All compartments are superiorly limited by the thoracic inlet and inferiorly limited by the diaphragm. The prevascular compartment is limited: anteriorly by the sternum, laterally by the parietal mediastinal pleura, and posteriorly by the anterior aspect of the pericardium. The anterior limit of the visceral compartment is the anterior aspect of the pericardium. It is posteriorly limited by a vertical line connecting a point on the thoracic vertebral bodies 1 cm posterior to the anterior margin of the spine. The anterior limit of the paravertebral space is the visceral compartment. It is posterolaterally limited by a vertical line along the posterior margin of the chest wall at the lateral aspect of the transverse processes. Tumors of the prevascular compartment include thymic malignancies, goiters, lymphomas, teratomas and malignant germ cell tumors. Neurogenic tumors account for the majority of the paravertebral compartment tumors. Tumors of the visceral compartment are more diverse, mainly metastatic adenopathies, small cell lung cancer and bronchogenic cysts. PET CT shows intense metabolic activity for lymphomas and malignant germ cell tumors, and moderate metabolic activity for thymomas. Serum markers (alpha-foetoprotein, beta HCG) allow diagnosis of malignant germ cell tumors.

Learning objectives

- To become familiar with the new classification of mediastinal compartments
- To learn about the main cause of mediastinal tumor for each compartment
- To learn about the role of PET and biological markers for diagnosis

LUNG CANCER STAGING

C. Schaefer-Prokop, Amersfoort/NL

Description

Lung cancer staging based on the 8th TNM edition. Based on the strong predictive value of tumor size, T1 and T2 stages are subdivided in single-cm-steps. Any mediastinal vet infiltration indicates T4. For the first time, determination of tumor size has to take into consideration all three projections (maximum diameter, in lung window in any of the three planes). Specific recommendations have been published for tumors presenting with multiple subsolid nodules or a pneumonic-like infiltration.

Even if mediastinal vet infiltration indicates T4, presence of absence of tumor infiltrations of vital structures need to be described as the T in TNM refers to tumor prognosis but not to options of respectability.

N staging has not changed between TNM 7 and TNM 8. Anatomic borders of the various lymph node staitons need to be considered (preferably in all three planes) to accurately differentiate N1 from N2 (e.g., station 4 versus station 10) or between N2 and N3 and the upper thoracic inlet.

M staging differentiates now between thoracic (M1a), single extra-thoracic (M1b) and multiple extra-thoracic (M1c) metastases indicating the importance of oligo-metastases for determining the treatment.

Image examples will illustrate the various stages, what to take into account for correct determination, the limitations of modern CT images and how PET and CT complement each other.

Learning objectives

- To get familiar with the definition of TNM 8 with focus on what has been changed since TNM 7
- To learn about the anatomic borders of the N stations
- To learn about the complimentary role of CT and PET

PET-CT EVALUATION LUNGS

M. Prokop, Nijmegen/NL

Description

PET-CT is well-established for the staging and follow-up of lymphoma, and for staging of bronchogenic cancer. This presentation will discuss the role of PET-CT for these indications but also for differentiation of benign and malignant nodules, and for establishing recurrence of treated lung cancers. Emerging indications include infectious and inflammatory diseases, such as septic emboli, vasculitis or sarcoidosis. Pitfalls and the complimentary role of a diagnostic CT will be extensively discussed. Suggestions for writing joint PET-CT reports will be provided.

Learning objectives

- To understand the role of PET-CT for staging and follow-up of lymphoma.
- To learn to interpret PET-CT for staging of lung cancer.
- To comprehend the issues when using PET-CT for differentiating pulmonary nodules.
- To learn about emerging indications of PET-CT
- To learn how to avoid pitfalls and write a joint PET-CT report.

IMAGING EVALUATION AFTER IMMUNETHERAPY

M-P. Revel, Paris/FR

Description

Immune checkpoint inhibitors now belong to the therapeutic landscape of lung cancer. The evaluation of tumor response to these new agents must be performed by using adapted criteria. Indeed, around 7% of patients experience response despite the apparition of new lesions or initial increase of target or non-target lesions, due to the afflux of T cells around the tumor cells. According to iRECIST criteria (for immune-related Response Evaluation Criteria in Solid Tumor), any apparent progression should thus be confirmed at 4 weeks, to distinguish between pseudo progression and true progression. Until next assessment, the progression is considered as uPD (unconfirmed progressive disease), and may be associated with an improved or worsened general status. There are no characteristics on imaging or site of progression allowing suspecting pseudo rather than true progression. Some patients on immunotherapy may experience a rapid paradoxical progression of tumor with worsening clinical status, which appears to negatively impact survival. This phenomenon, still debated, has been termed hyperprogressive disease (HPD). HPD was defined as a ≥2-fold increase in tumor growth rate (TGR) between baseline and first assessment, but there are other definitions including a time-to-treatment failure of less than 2 months. HPD may affect up to 16% with non-small-cell lung cancer and cannot be predicted based on clinical, molecular or pathological characteristics. Repeat biopsy is warranted to distinguish pseudo and hyperprogression.

Learning objectives

- To understand the difference between RECIST (Response Evaluation Criteria In Solid Tumors) and iRECIST criteria (i for immune)
- To learn about the frequency and characteristics of pseudo progression
- To learn about the concept of hyperprogressive disease

ARTIFICIAL INTELLIGENCE IN CHEST RADIOLOGY

F. Gleeson, Oxford/UK

Description

Artificial Intelligence, AI, or machine learning has the potential for aiding clinical diagnosis in patients with suspected chest disease. It has a potential role in basic chest imaging, the CXR, and in more sophisticated chest imaging CT and PET-CT. Recent reports suggest that AI may help identify normality in routine chest imaging, identify and characterise pulmonary nodules in CT scans, and may improve image quality in PET-CT. This presentation will outline the basics of AI, its limitations at present, the published reports on its use in chest imaging, and its potential use in the future.

Learning objectives

- To learn the basics of artificial intelligence in chest imaging
- To appreciate its limitations at present
- To understand its potential benefits in the future

LUNG CANCER SCREENING, NODULE MANAGEMENT

M. Prokop, Nijmegen/NL

Description

Lung cancer screening has been shown to reduce mortality from lung cancer by 20% to over 60% (NLST, NELSON). The positive effect is substantially higher in women (LUSI, NELSON). After the first screening rounds that remove the prevalent cancers form the screening population, there is evidence for a substantial reduction of all-cause mortality by > 30% (MILD). Many European countries are now busy with evaluating how to implement screening. This course will discuss the arguments about participant recruitment and selection, low-dose CT scans, optimum reading and management strategies. It will discuss how nodule management in clinical routine differs from nodule management in a screening program.

Learning objectives

- To understand why lung screening should be established soon
- To learn how to best recruit participants
- To learn how to perform and read a low-dose screening CT
- To comprehend how to choose and use a suitable nodule management guideline

IMAGING COPD

S. Padley, London/UK

Description

Chronic Obstructive Pulmonary Disease is one the commonest reasons for referral to a respiratory service. Treatment options have expanded over the past two decades beyond medical optimization and support to active intervention with a wide variety of techniques. This presentation will explore the imaging assessment of COPD.

There is now the opportunity to undertake qualitative assessment of the lung parenchyma in patients being worked up for chronic obstructive pulmonary disease, based on both lung densitometry maps and perfusions assessment.

These techniques allow treatment planning, with interventions being chosen based on the individual's patterns of disease, disease homogeneity, fissure anatomy and coexisting pathology.

The current range of interventions, from conventional lung volume reduction surgery to targeted bullectomy and a range of transbronchial therapies, will be discussed.

Some of these therapies are in development, others are more firmly established.

Learning objectives

- Develop an approach to the accurate assessment of severity and distribution of disease.
- Understand the importance of fissure completeness assessment.
- Appreciate the significance of
  · bronchial wall thickening
  · excessive secretions
  · unexpected incidental small tumours
  · pulmonary vascular remodelling

IMAGING OF PULMONARY VASCULOPATHIES

S. Copley, London/UK

Description

There are different classifications of pulmonary vascular diseases such as by the size of vessels affected, by site (arterial -v- venous), by histopathologic pattern, by cause or clinico-serological-radiological features. However, the radiological correlate of these classifications is often not clear-cut and it may be helpful to consider inflammatory pulmonary vasculopathies versus occlusive vasculopathies in terms of imaging features.

Vasculitides are a heterogeneous group of autoimmune diseases, all characterized by inflammation of blood vessels (vasculitis) and subsequent ischemia and damage to the organs supplied by these vessels. Traditionally, they are categorized by the size of vessel affected, however the imaging features are usually florid but non-specific. By contrast, the imaging features of occlusive vasculopathies are often chronic and subtle.

Learning objectives

- To understand the different imaging manifestations of pulmonary vasculopathies
- To categorize the radiological features as either inflammatory or occlusive

CT OF SMALL AIRWAYS

S. Copley, London/UK

Learning objectives

- Small airways have a diameter of less than 2mm and consist of the terminal bronchiole and airways beyond
- Terminology regarding small airways disease can be confusing but can be broadly categorized into exudative bronchiolitis and constrictive obliterative bronchiolitis
- Exudative bronchiolitis is commonly associated with infection and characterized by a tree in bud pattern on CT
- There are many causes of obliterative constrictive bronchiolitis including post viral infection, toxic fume inhalation, graft versus host disease, connective tissue disease related and associated bronchiectasis
- The CT appearances of constrictive obliterative bronchiolitis are 'indirect' and consist of a mosaic attenuation pattern, vascular constriction and air trapping on end expiratory images

References
Hogg JC et al. Site and nature of airway obstruction in chronic obstructive lung disease. N Engl J Med 1968;278:1355-1360
Hansell DM. Obliterative bronchiolitis: individual CT signs of small airways disease and functional correlation. Radiology 1997;203: 721-726
Hansell DM Small airways disease: detection and insights with computed tomography Eur Respir J 2001;17:1294

CT OF THE TRACHEA AND LARGE AIRWAYS

M. Prokop, Nijmegen/NL

Description

CT evaluation of the trachea and large airways can be performed on routine thin-section CT but expiratory or dynamic scans may be required to optimally diagnose certain diseases. Simple and more complex visualization techniques will be discussed. Cartilaginous and membranous portions of the tracheobronchial system are uniquely affected by various diseases. The course will discuss congenital variants and findings in trauma, infections, inflammatory disorders, neoplasms. It will cover a wide spectrum of tracheal diseases and provide guidance on how to best establish the most likely diagnosis in patients with abnormalities in the tracheobronchial system.

Learning objectives

- To learn how to assess tracheobronchial stability with expiratory and dynamic CT scans
- To become familiar with various visualization techniques for the tracheobronchial system and when to use them
- To understand tracheobronchial anatomy and how various diseases differentially affect the cartilaginous and membranous components
- To learn how to best differentiate the various diseases affecting the tracheobronchial system

NORMAL VARIANTS ON HRCT

S. Copley, London/UK

Teaching points

- The recognition of pathological disease versus physiological normal variants is crucial in radiological diagnosis
- There are several HRCT features (including ground glass opacity, air trapping and reticular pattern) which have been recognised in asymptomatic healthy subjects
- The appearances in normal older individuals (such as large airway abnormalities, a subpleural reticular pattern and cysts) will be highlighted

Learning objectives

- To learn about the HRCT features which may be present in asymptomatic healthy individuals
- To understand the possible pathological explanations for these appearances
- To recognise how normal variants on HRCT may mimic disease

References/Further Reading
1. Lee et al. Correlation of Aging and Smoking with Air Trapping at Thin-Section CT of the Lung in Asymptomatic Subjects. Radiology 2000;214:831-836
2. Tanaka et al. Air Trapping at CT: High Prevalence in Asymptomatic Subjects with Normal Pulmonary Function. Radiology 2003;227:776-785
3. SJ Copley, AU Wells, KE Hawtin, DJ Gibson, JM Hodson, AET Jacques and DM Hansell. Lung morphology in the elderly: a comparative CT study of subjects over 75 year old and those under 55 years of age. Radiology 2009;251:566-573

DRUG INDUCED LUNG DISEASE

C. Schaefer-Prokop, Amersfoort/NL

Description

Drug induced lung disease can cause almost any pattern of interstitial lung disease. The most often seen pattern is NSIP and organizing pneumonia. In addition also non-parenchymal changes such as pleural effusion or lymphadenopathy are seen.

Though there is no specific pattern associated with a specific drug, there are certain associations that are of help in the differential diagnosis. Drug induced lung disease has to be differentiated from infection, cardiac edema and manifestations of the underlying disease. The number of drugs potentially causing parenchymal or other thoracic pathology is increasing (www.pneumotox.com). Complications of targeted chemotherapy and immunotherapy in oncologic patients will be covered.

Learning objectives

- To get familiar with patterns of drug induced lung disease
- To learn which pathology can be expected in which groups of medication (e.g., antibiotics versus chemotherapy)
- To learn how to differentiate drug induced lung disease from other pathology seen in the lung parenchyma

Abstracts appear as submitted and have not been checked for correctness and completeness.

ACCREDITATION

UEMS – CME ACCREDITATION

The ESTI Winter Course 2019, Tromsø, Norway, 12/12/2019-14/12/2019 has been accredited by the European Accreditation Council for Continuing Medical Education (EACCME®) with **12 European CME credits** (ECMEC®s). Each medical specialist should claim only those hours of credit that he/she actually spent in the educational activity.

Through an agreement between the Union Européenne des Médecins Spécialistes and the American Medical Association, physicians may convert EACCME® credits to an equivalent number of AMA PRA Category 1 Credits™. Information on the process to convert EACCME® credit to AMA credit can be found at http://www.ama-assn.org/education/earn-credit-participation-international-activities.

Please find below the breakdown of ECMEC®s per day:

12.12.2019	3.00
13.12.2019	6.00
14.12.2019	3.00

DISCLOSURE STATEMENT

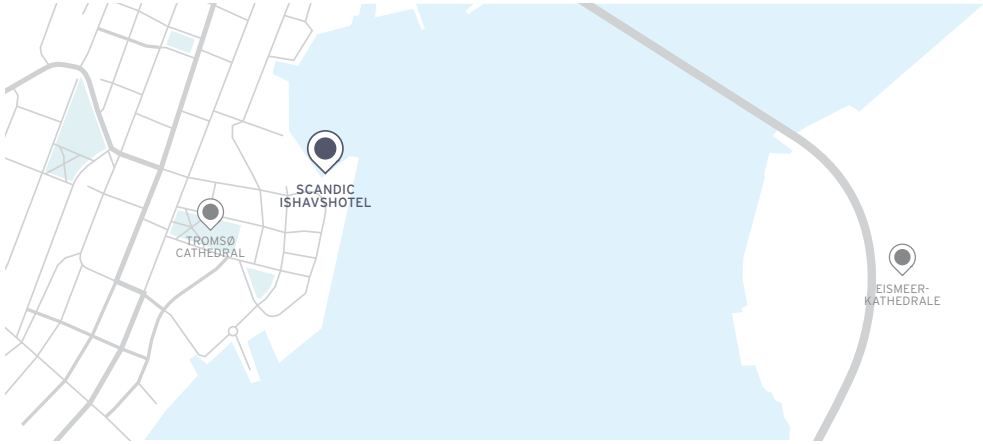
POTENTIAL CONFLICT OF INTEREST DISCLOSURES

It is the policy of ESTI (European Society of Thoracic Imaging) to ensure balance, independence, objectivity, and scientific rigour in the congress programme. Knowledge of possible relationships with sponsors of any kind is mandatory in order to reinforce the educational and scientific message and to relieve any suspicion of bias.
Any potential conflict of interest involving the organising committee should be made known so that the audience may form their own judgements about the presentation with a full disclosure of the facts. It is for the audience to determine whether the presenter's external interest may reflect a possible bias in either the work carried out or the conclusions presented.

The ESTI Winter Course 2019 Organiser, Dr. Anagha P. Parkar, did not disclose any relationships.

GENERAL INFORMATION

Course Venue
Scandic Ishavshotel
Fredrik Langesgate 2
NO-9008 Tromsø
Norway



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Onsite Office
In case of any questions, kindly consult the staff persons at the registration desk. They will be happy to assist you.

Registration Desk Opening Hours

Thursday, December 12	11:30-18:10
Friday, December 13	08:00-17:30
Saturday, December 14	08:00-13:00

Course Language

The course will be held in English. No simultaneous translation will be offered.

Registration fee for delegates includes

- admittance to all sessions
- admittance to the industry symposia
- congress programme including abstract syllabus
- certificate of attendance
- coffee breaks & lunch

Mobile Phones

Please do not forget to switch off your mobile phone before entering the lecture room.

Breaks

Complimentary coffee, tea and refreshments will be served during the official coffee breaks to all meeting delegates. Lunch is offered during the lunch breaks.

Recording

Photo-, video- or audio-recording of any sessions or presentations is not allowed without the speaker's/ organiser's prior written permission.

Future Meeting Desk

This area offers you an overview of future meetings in the field of radiology and related disciplines, from all over the world. Feel free to contribute flyers and posters to promote your own meetings and courses.

Boehringer Ingelheim

Interstitial Lung Disease (ILD) from a pulmonologist's point of view

Boehringer Ingelheim-sponsored Lunch Symposium at ESTI Winter Course 2019

Please join us for an ILD symposium sponsored by Boehringer Ingelheim

Introduction: Anagha Prabhakar Parkar
Radiologist, Haraldsplass Diakonale Sykehus
Secretary ESTI

Speaker: Tomas Eagan
Pulmonologist, Haukeland University Hospital
Professor, Department of Clinical Science, University of Bergen

Time: Friday December 13th 12.10 - 13.10

Best regards,
Boehringer Ingelheim

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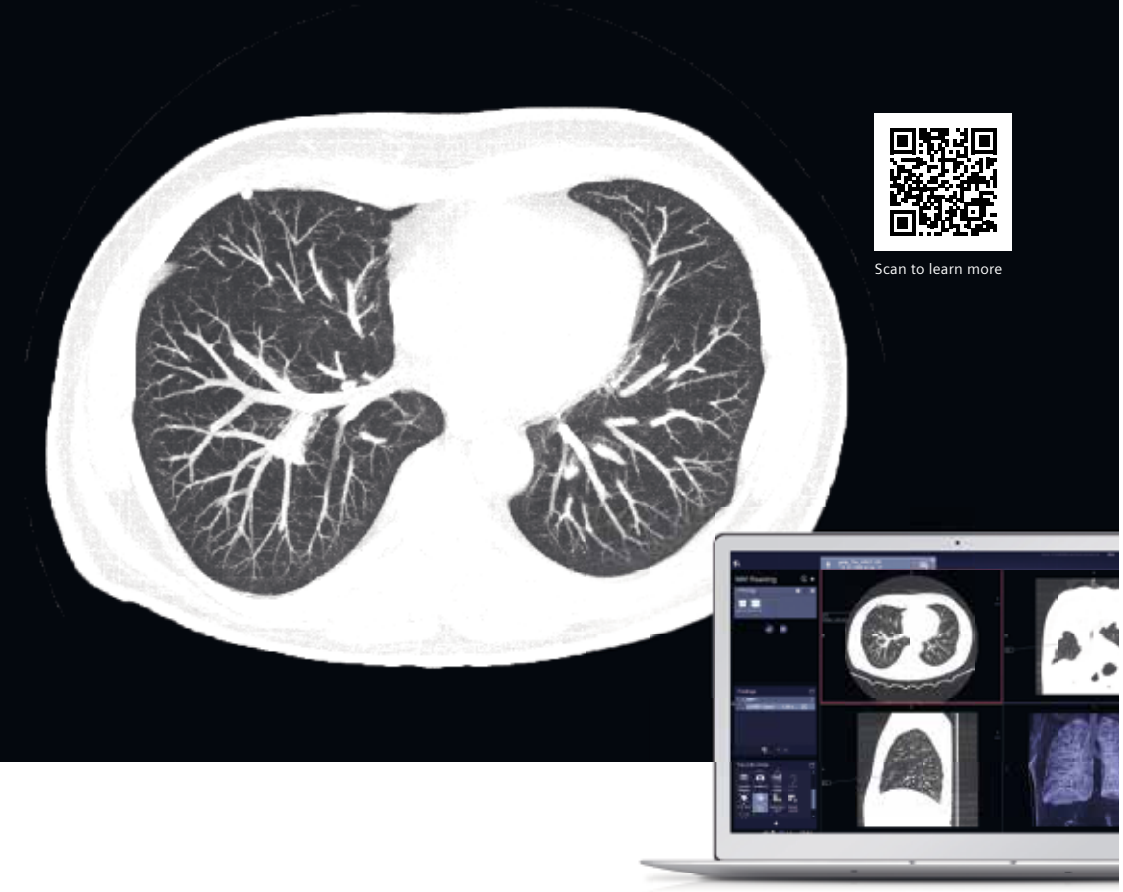

Scan to learn more

Lung cancer screening at plain X-ray dose

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SIEMENS Healthineers

Get further with your CT

Have you ever wondered ...

... why we see so many technologies driving the reduction of dose in post-contrast imaging, yet not so much attention is paid to non-contrast studies?

Non-contrast imaging is significant ...

... in routine radiology. It accounts for approximately 30% of all patients in routine cases[1] and encompasses a wide range of anatomies. Lowering the dose for these patients is equally important.

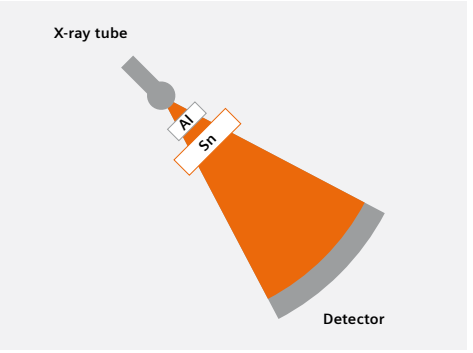
How can we help you to open up your business to a greater patient population?

How can you achieve low dose and reduce risk without compromising on quality?

Tin Filter: 3D data at 2D dose

By introducing the Tin Filter technology to the entire Siemens Healthineers CT portfolio, we support you to reduce dose for all patients, and to open up additional clinical pathways for better patient outcomes.

By shaping the beam, you can significantly reduce the absorbed low-kV spectrum, so the exposure is reduced to the point that these scans are reaching dose levels previously seen only in general radiography i.e., in chest X-rays, and hand and wrist X-rays. Tin Filter technology is shifting the clinical pathway from 2D imaging to 3D imaging.



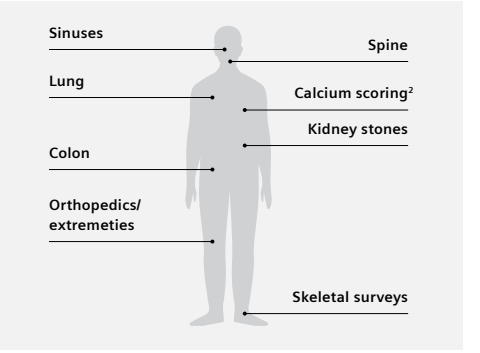
Clinical cases

Strive for the lowest dose achievable, with CT at X-ray dose levels

Each patient benefits directly from dose reduction, right from the first planning scan. Lung cancer screening doses may be reduced to levels seen only with plain X-ray.

Orthopedic imaging can see a shift from routine 2D X-ray to the high-resolution world of 3D CT imaging.

From head to toe, the Tin Filter can add significant benefits, advance clinical pathways, and bring a new level of care to your patients.



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[1] *based on internal data analysis*
[2] *scan mode available only on selected systems*

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The Certificate of Attendance can be downloaded after the course upon entering the ESTI MyUserArea. To enter the ESTI MyUserArea, please login with your username in combination with your personal password.

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The safety of all congress delegates and participants is of utmost importance to ESTI. Security measures and precautions at the ESTI Winter Course venue have been tightened to ensure maximum security for all attendees. Badges must be worn visibly on the course grounds at all time. ESTI reserves the right for staff to check participants' identification upon admission to and/or inside the course venue. Participants may at any time be requested to present adequate proof of identity in the form of a passport, driver's license, national or military identification or student ID. Documents for the proof of identity must include a photograph and signature.

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INDUSTRY SPONSORED SYMPOSIA

THURSDAY, DECEMBER 12, 2019, 14:20-15:20

14:20 **Recent advances in Chest CT**
M. Lell, Nuremberg/DE

SIEMENS Healthineers

14:50 **Innovations along the workflow for Chest CT imaging**
J. Merz, Forchheim/DE

FRIDAY, DECEMBER 13, 2019, 12:10-13:10

ILD – As seen by a pulmonologist
Tomas Eagan, pulmonologist, Haukeland University Hospital & Professor University of Bergen

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Lunch will be served after the symposium from 13:10-14:00.

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We thank our industry partners for their highly appreciated support of the second ESTI Winter Course 2019:

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NOTES

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ESTI 2020

28th ANNUAL SCIENTIFIC MEETING OF THE EUROPEAN SOCIETY OF THORACIC IMAGING

JUNE 04-06, 2020

OXFORD, UNITED KINGDOM

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