



European Training Curriculum for Sub- specialisation in Radiology

Curriculum for the Level III
Training Programme
(Subspecialisation beyond Year 5)

PREFACE TO THE EUROPEAN TRAINING CURRICULUM FOR SUBSPECIALISATION IN RADIOLOGY

The European Training Curriculum for Subspecialisation in Radiology provides curricular contents for a full subspecialisation in the field of radiology corresponding to Level III training. Level III training should be a formal, full-immersion training in a radiological subspecialty with an expected minimum of one year after the completion of radiology (Level I and Level II) training. Level I and II contents are provided in the European Training Curriculum for Radiology with Level I covering years 1 to 3 and Level II covering years 4 and 5 of training.

The European Training Curriculum for Subspecialisation in Radiology is a living document and needs to be reviewed at regular intervals in order to keep up with current developments in the profession. The societies contributing to the development of the ETC provided, where necessary, important updates to their respective chapters. Furthermore, the chapter on Medical Imaging Informatics, first introduced by the European Society of Medical Imaging Informatics (EuSoMII) in the 2018 version of the ETC, underwent a substantial revision and its content was redefined by the ESR eHealth and Informatics Subcommittee in collaboration with EuSoMII.

I would like to acknowledge the contribution of all ESR Subspecialties and Allied Sciences Member Societies, the eHealth and Informatics Subcommittee, the ESR Subspecialties and Allied Sciences Committee, the Board of Directors and the Executive Council of the European Society of Radiology as well as all the office team of the ESR for their immensely valuable support.

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Carlo Catalano
Chairperson of the ESR Education Committee
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FRAMEWORK FOR SUBSPECIALTY TRAINING IN EUROPE

1. DURATION AND STRUCTURE OF TRAINING

Level III Training is a formal, full-immersion training in a radiological subspecialty; a minimum of one year is expected after the completion of radiology (Level I and Level II) training. The European Training Curriculum for Radiology outlines a five-year (3 + 2) training period, consisting of Level I Training over the first three years followed by a more flexible Level II Training with potential special interest (subspecialty) rotations during the last two years.



B-III:
**LEVEL III
TRAINING
(BEYOND YEAR 5)**

B-III-3

CHEST RADIOLOGY / THORACIC IMAGING

Content provided by ESTI (European Society of Thoracic Imaging)

KNOWLEDGE

- To have an in-depth working knowledge of common respiratory diseases / disorders, including:
 - » Infections of the lungs and pleura
 - » Tumours (benign and malignant of the lungs, pleura, mediastinum and chest wall and vessels)
 - » Airways diseases
 - » Pleural disorders
 - » Diffuse parenchymal lung diseases
 - » Thoracic disorders caused by trauma
 - » Pulmonary disorders in critically-ill patients
 - » Pulmonary disorders occurring following surgery
 - » Congenital disorders of the lungs, airways and mediastinum
 - » Pulmonary arterial (including bronchial arterial) and aortic vascular diseases
 - » Iatrogenic (post-surgical, drug- or radiation-induced) lung disorders
- To have an in-depth knowledge of the aetiologies, epidemiology and prognoses of common respiratory diseases
- To have a core understanding of the key patho-physiological inter-relationships in cardio-pulmonary disease
- To know the common clinical presentations of respiratory disease
- To understand the importance and significance of the following symptoms, signs and/or clinical presentations:
 - » Chest pain (pleuritic or otherwise)
 - » Dyspnoea
 - » Pyrexia (in immunocompetent or immunocompromised hosts)
 - » Massive haemoptysis
 - » Persistent cough (dry or productive)
 - » Wheezing
 - » Recurrent infections or infections 'unresponsive' to treatment
 - » Stridor
 - » Persistent hoarseness
 - » Hypoxia
- To know the correct terminology (based on the 2008 Fleischner Society document) when reporting the radiological signs of pulmonary disease
- To have an in-depth knowledge of the capabilities, limitations and potential detrimental effects of imaging procedures or tests such as guided biopsy, percutaneous drainage, radiofrequency / microwave ablation of intrathoracic tumours
- To be aware of most recent technical advances in the field of thoracic radiology

- To have an in-depth knowledge of the utility and limitations of the following imaging tests:
 - » Plain chest radiography
 - » Computed tomography
 - » PET/CT (PET/MR) and other nuclear medicine techniques (e.g. V/Q scintigraphy, SPECT) including radiotracers used in hybrid imaging
 - » Magnetic resonance imaging
 - » Ultrasound
- To know the local, national and international guidelines or position statements issued by learned societies / bodies, to include but not restricted to the following:
 - » Lung cancer screening guidelines (e.g. US Preventive Services Taskforce Recommendation statement [2013]; American Cancer Society guidelines [2013]; American College of Chest Physicians guidelines [2013]; The NELSON Trial [2013]; The UKLS Lung Screen [2011])
 - » Current Fleischner Society guidelines & recommendations suspected acute pulmonary embolism
The British Thoracic Society Nodule guideline (Callister MEJ et al., Thorax 2015)
 - » Current ATS/ERS idiopathic interstitial pneumonia classification update
- To understand the concepts and concerns related to radiation dose and dose reduction as applied to thoracic imaging
- To have an in-depth knowledge of:
 - » Typical doses in chest radiography and CT (including doses delivered during thoracic intervention)
 - » Typical doses and radiation exposures in hybrid imaging and scintigraphy / SPECT
 - » Units of radiation dose (i.e. milliSieverts [mSv])
 - » The concept of effective dose, computed tomography dose index (CTDI), dose length product (DLP) and the conversion factors for calculation of effective dose from the DLP
 - » The concept of effective dose and dose area product (DAP) for radiographs
 - » Dose reduction techniques in thoracic CT techniques with reference to kilovoltage (kV), tube current-time product (mAs), pitch, automatic exposure control / dose modulation
 - » Low-dose and 'ultralow' dose (sub-millisievert) multidetector CT scanning
 - » Iterative reconstruction techniques
- To understand the following imaging protocols:
 - » CT pulmonary angiography
 - » CT aorta without and with contrast
 - » Staging, treatment, planning and follow-up CT and hybrid imaging (for thoracic malignancies)
 - » High-resolution CT (interspaced HRCT versus volumetric acquisitions)
 - » Low-dose / ultralow dose CT (for follow-up; lung cancer 'screening' studies)
 - » Chest MRI (e.g. in selected patients with chest wall or mediastinal tumours)
- To understand the key difference between urgent findings (some of which might be clinically-unsuspected) and non-urgent findings on thoracic imaging studies and the importance of relaying this information in a timely fashion

- To have an in-depth understanding of the following urgent radiological findings:
 - » Acute pulmonary embolism (including signs of right heart strain)
 - » Acute aortic pathology (including aortic rupture, dissection, intramural hematoma)
 - » Free intraperitoneal air under the diaphragm (in a patient not having undergone recent abdominal surgery)
 - » Large pneumothorax with contralateral mediastinal shift
 - » Significant tracheal narrowing (caused by external compression, intra-tracheal mass)
 - » Impending superior vena caval obstruction by tumour
 - » Widespread opportunistic infection in immunocompromised hosts
- To know the typical imaging signs and patterns of the following neoplastic disorders of the chest:
 - » Lung cancer
 - » Subtypes of lung cancer (small cell versus non-small cell lung cancer)
 - » New classification of adenocarcinomas (incl. atypical adenomatous hyperplasia, adenocarcinoma in situ, minimally invasive adenocarcinoma, invasive adenocarcinoma)
 - » Other thoracic neoplasms (benign and malignant), including mediastinal / tracheal tumours
 - » Lymphoma
 - » Oesophageal cancer
 - » Hamartoma
 - » Tracheal carcinoma
 - » Thymic tumours
 - » Thyroid neoplasms
 - » Mediastinal germ cell tumours
 - » Foregut duplication cysts
 - » Neurogenic tumours
 - » Mediastinal sarcoma
- To know the typical imaging signs and patterns of the following infectious disorders of the chest (including infections in the immunocompromised host & nosocomial pneumonias):
 - » Bacterial
 - » Mycobacterial (tuberculous and non-tuberculous)
 - » Viral
 - » Fungal
 - » Parasitic
- To know the typical imaging signs and patterns of acute and chronic pulmonary thromboembolic disease (and to understand the capabilities and limitations of radiological tests in each)
- To know the typical imaging signs and patterns of the following types of emphysema:
 - » Centrilobular
 - » Paraseptal
 - » Panacinar / panlobular

- To know the typical imaging signs and patterns of the following tracheal diseases:
 - » Tracheal stenosis
 - » Tracheobronchomalacia
 - » Tracheal tumours
- To know the typical imaging signs and patterns of the following bronchial disorders:
 - » Bronchiectasis
 - » Broncholithiasis
 - » Small airways disease (constrictive obliterative bronchiolitis, 'exudative' bronchiolitis)
- To know the typical imaging signs and patterns of pulmonary hypertension
- To know the typical imaging signs and patterns of the following forms of pneumonias / interstitial pneumonias (idiopathic or otherwise):
 - » Usual interstitial pneumonia
 - » Non-specific interstitial pneumonia
 - » Smoking-related interstitial lung diseases
 - » Acute interstitial pneumonia
 - » Organising pneumonia
 - » Lymphoid interstitial pneumonia
- To know the typical imaging signs and patterns of the following other diffuse parenchymal lung diseases:
 - » Sarcoidosis
 - » Hypersensitivity pneumonitis
 - » Cystic lung diseases (Langerhans' cell histiocytosis, tuberous sclerosis / lymphangioleiomyomatosis, lymphoid interstitial pneumonia, Birt-Hogg-Dubé disease)
 - » Asbestosis and other occupational lung diseases
 - » Amyloidosis
 - » Alveolar proteinosis
 - » Alveolar microlithiasis
 - » Eosinophilic pneumonias
 - » Vasculitides
 - » Pleuroparenchymal fibroelastosis (see also: Pleural disorders)
 - » Pulmonary haemorrhage syndromes
 - » Drug-induced lung disease
- To know the typical imaging signs and patterns of the following congenital thoracic disorders
 - » Bronchial atresia
 - » Congenital pulmonary adenomatous malformation
 - » Pulmonary sequestration
 - » Congenital lobar emphysema
 - » Pulmonary hypoplasia / agenesis

- To know the typical imaging signs and patterns of the following pleural disorders:
 - » Pleural effusion and empyema
 - » Benign diffuse pleural thickening
 - » Pleural calcification / pleural plaques
 - » Pneumothorax / hydropneumothorax
 - » Bronchopleural fistula
 - » Pleural tumours (pleural fibroma, lipoma, malignant pleural mesothelioma, secondary pleural malignancy [e.g. adenocarcinoma, lymphoma])
 - » Pleuro-parenchymal fibroelastosis (see also: Other diffuse parenchymal diseases)
- To know the typical imaging signs and patterns of the critically-ill patient and/or the patient after major traumatic injury:
 - » Pulmonary oedema (cardiogenic, non-cardiogenic / ARDS)
 - » Position of lines / tubes / catheter and other devices, and complications of misplacement
 - » Barotrauma / pneumothoraces (e.g. signs of tension on mobile plain films)

SKILLS

- To prepare a patient for CT of the chest including indication, justification, and venous access
- To optimise acquisition parameters for chest CT
- To understand and select the optimal post-processing tools for chest CT and hybrid imaging
- To prepare a patient for chest MRI including indication, justification and venous access
- To optimise acquisition parameters for chest MRI
- To identify typical artefacts in radiographic examinations, CT, MRI and hybrid imaging of the chest and to optimise parameters accordingly
- To perform post-processing for chest imaging studies, including multiplanar reformations (MPR), maximum intensity projections (MIP), minimum intensity projections (MinIP), volume rendering tools (VRT) and vessel analysis tools
- To confidently use the correct terminology (based on the 2008 Fleischner Society document) when reporting the radiological signs of pulmonary disease
- To perform ultrasound and/or CT-guided biopsy of lung nodules / masses
- To perform ultrasound and/or CT-guided drainage of intrathoracic collections
- To perform radiofrequency and/or microwave ablation of primary or secondary lung tumours, to understand the indications capabilities and limitations of each technique
- To perform and present research-related work related to scientific questions and/or evidence-based improvement and quality work in the field of chest radiology
- To critically review the literature and research articles in the field
- To conduct a research study and to evaluate and present the results in a scientific manner
- To understand the potential impact of technological development and learn how to translate results of research into clinical practice

COMPETENCES AND ATTITUDES

- To require minimal supervision from senior colleagues in the routine thoracic imaging workflow
- To justify chest imaging examinations for the individual patient situation
- To choose the best-suited method to address specific clinical questions in thoracic radiology according to current guidelines
- To communicate with the patient and to obtain informed consent prior to chest imaging
- To describe and explain the nature of potentially complex radiological tests / procedures in thoracic imaging to patients and, where necessary, clinical colleagues
- To appreciate and respect the roles and work of other non-medical personnel (including radiographers, nurses, support staff, secretaries etc.) in the thoracic imaging unit and communicate with them in a professional manner
- To actively and positively interact with the other specialists of the multidisciplinary team (such as thoracic surgeons, pulmonologists, respiratory therapists etc.), being an integrated member of the team in planning diagnostic studies, therapies and in outcome review
- To choose optimal protocols for radiographic, CT, MRI and hybrid imaging examinations of the chest
- To create and apply protocols and standard operating procedures to reduce exposure doses for radiological examinations in thoracic radiology
- To supervise and teach technical staff to ensure that appropriate images are obtained for all radiological methods in chest radiology
- To judge the quality of imaging examinations in thoracic radiology and to devise strategies to maintain high quality standards
- To link clinical presentations and radiological findings in thoracic imaging with likely diagnosis or, at least, reasoned differential diagnoses
- To construct a concise, informative radiology report in thoracic imaging with, where appropriate, recommendations for further radiological tests
- To confidently interpret and report radiographic CT, MRI and hybrid imaging of the chest
- To discuss radiological findings in respiratory medicine with referring physicians at peer level
- To confidently lead the radiological aspects of multidisciplinary team meetings in thoracic imaging
- To be able to discuss both routine and more complex thoracic imaging cases with radiology colleagues, referring clinicians and patients, also explaining the level of uncertainty of particular cases
- To appreciate and respect the roles and work of other non-medical personnel (including radiographers, nurses, support staff, secretaries etc.) in the thoracic imaging unit and communicate with them in a professional manner
- To prioritise radiological workflow in chest imaging as based on clinical urgency
- To identify urgent and/or unexpected findings in imaging examinations of the chest and to communicate these timely and properly
- To identify complex cases in thoracic imaging, in which it is appropriate to obtain a second opinion for interpreting and reporting
- To retrieve current information on state-of-the-art procedures in thoracic imaging such as guidelines from national and international societies

- To continuously keep abreast of the key recent publications, including international guidelines and position statements (e.g. from the European Respiratory Society, The Fleischner Society, The American Thoracic Society) in the field of respiratory medicine, pathology and radiology
- To have audit and research skills in chest imaging
- To present findings and lecture at meetings relevant to thoracic imaging
- To teach thoracic imaging
- To participate in discussions with other staff regarding operational challenges and potential system solutions regarding the workflow and other aspects of the thoracic radiology service