

# ECR 2021

## PRELIMINARY PROGRAMME

### ON-DEMAND

#### MARCH 3-7



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PRELIMINARY PROGRAMME AS OF  
DECEMBER 20, 2020.

NO UPDATES WILL BE MADE UNTIL THE  
PUBLICATION OF THE FINAL PROGRAMME.

**ESR** EUROPEAN SOCIETY  
OF RADIOLOGY

**ECR 2021**

**ON-DEMAND PROGRAMME**

|| CLICK ON THE SESSION TITLE FOR MORE DETAILS ||

**E<sup>3</sup> - Rising Stars Programme: Basic Sessions**

- BS 2 - Introducing elastography
- BS 3 - Radiation dose and image quality optimisation
- BS 4 - Equality, diversity, and inclusion (EDI) issues for radiography
- BS 5 - Radiography: raising the profile of our profession
- BS 6 - Abdominal viscera: liver imaging
- BS 7 - Genitourinary
- BS 9 - Cardiovascular imaging
- BS 10 - Neuroradiology
- BS 12 - Radiologic anatomy: abdomen

**E<sup>3</sup> - The Beauty of Basic Knowledge: Breast**

- E<sup>3</sup> 24A - Basics of mammography
- E<sup>3</sup> 24C - Basics of breast MRI
- E<sup>3</sup> 24D - Basics of interventional breast imaging
- E<sup>3</sup> 24E - How to deal with common clinical breast symptoms

**E<sup>3</sup> - The Beauty of Basic Knowledge: Understanding MRI Technique and MRI Safety**

- E<sup>3</sup> 25B - Static magnetic fields
- E<sup>3</sup> 25C - Time varying electromagnetic fields
- E<sup>3</sup> 25D - MRI in the presence of implants
- E<sup>3</sup> 25E - Working in the MRI environment

**E<sup>3</sup> - European Diploma Prep Sessions**

- E<sup>3</sup> 123 - Gastrointestinal and abdominal
- E<sup>3</sup> 223 - Neuro
- E<sup>3</sup> 323 - Principles of imaging and radiation protection
- E<sup>3</sup> 423 - Chest
- E<sup>3</sup> 523 - Musculoskeletal
- E<sup>3</sup> 623 - Breast



## Special Focus Sessions

- SF 3 - The prince that was promised: status of PET/MRI after the first 10 years
- SF 4 - CT-derived fractional flow reserve: hope or hype in cardiac imaging?
- SF 6 - Tumour profiling: established and novel MRI techniques
- SF 14 - Chest emergencies
- SF 16 - Risk-adjusted screening for breast cancer
- SF 18 - Deep learning and image quality
- SF 23 - Organ transplantation
- SF 24 - Oral and maxillofacial radiology

## State of the Art Symposium

- SA 2 - Radiological management of polytrauma

## Professional Challenges Sessions

- PC 2 - Radiology reporting in the age of computer-based interpretation
- PC 3 - The future of ultrasound in radiology

## Coffee & Talk (open forum) Session

- C 9 - Tracheobronchomalacia (TBM): optimising the diagnostic approach to this increasingly important childhood entity

## Refresher Courses: Abdominal and Gastrointestinal

- RC 101 - Benign and malignant lesions in "forgotten organs"
- RC 201 - Common benign and malignant liver lesions: unusual radiological appearance
- RC 301 - Imaging of pancreatitis
- RC 401 - Imaging of the biliary system

## Refresher Courses: Breast

- RC 202 - The radiologist and the oncoplastic surgeon: the importance of interaction for successful imaging evaluation
- RC 302 - Interventional breast imaging: the increasing role of the radiologist
- RC 402 - Update on lesions with uncertain malignant potential (B3)
- RC 502 - State of the art and recent developments in breast ultrasound

## Refresher Courses: Cardiac

- RC 103 - Imaging the complexity of pulmonary hypertension (PH) "syndrome"
- RC 403 - Cardiac imaging in special patient populations



### **Refresher Courses: Chest**

RC 204 - Thoracic emergencies: part 2

RC 504 - Pleural disease revisited

### **Refresher Courses: Imaging Informatics**

RC 105 - How to manage data: moving patients' data across hospitals, regions, and countries

### **Refresher Courses: Hybrid, Molecular and Translational Imaging**

RC 106 - Advancing clinical hybrid imaging

### **Refresher Courses: Genitourinary**

RC 107 - Imaging of benign female pelvis

RC 207 - Imaging of recurrent gynaecological cancer

### **Refresher Courses: Head and Neck**

RC 108 - Imaging of 'glands' in the head and neck

RC 308 - Imaging of head and neck trauma

RC 408 - Granulomatous disease and its mimics in the head and neck

### **Refresher Courses: Musculoskeletal**

RC 210 - Musculoskeletal imaging in rheumatology

RC 310 - The unstable joint

RC 410 - My top three tips for musculoskeletal ultrasound imaging

RC 510 - MRI of the knee

RC 610 - Musculoskeletal tumours

RC 710 - Musculoskeletal infection

RC 810 - Essential measurements and classifications in musculoskeletal joint imaging

### **Refresher Courses: Neuro**

RC 111 - Craniocervical junction

RC 211 - Sellar and parasellar lesions

RC 311 - Neuromuscular imaging

RC 411 - Aging brain imaging: essential clues for diagnosis

RC 611 - Cerebrospinal fluid (CSF) and glymphatic system imaging



### **Refresher Courses: Paediatric**

- RC 112 - Learning from common errors and discrepancies in paediatric radiology
- RC 212 - Imaging the small ones: tips and tricks in neonatal imaging
- RC 412 - Imaging of frequent queries in children: an evidence-based approach
- RC 512 - Polytrauma management

### **Refresher Courses: Physics in Medical Imaging**

- RC 413 - Radiation dose monitoring systems (RDMS): from commissioning to effective use
- RC 513 - Quantification of magnetic resonance imaging parameters in clinical practice

### **Refresher Courses: Radiographers**

- RC 214 - Imaging and advanced practice in radiotherapy
- RC 314 - Developments and practice in ultrasound
- RC 514 - Updates in forensic imaging

### **Refresher Courses: Vascular**

- RC 115 - Venous thrombotic disease

### **Refresher Courses: Oncologic Imaging**

- RC 116 - Peritoneal carcinomatosis: the role of imaging in detection and treatment planning?
- RC 316 - Role of imaging in immunotherapy: tumour response assessment and complications

### **Refresher Courses: Emergency Imaging**

- RC 117 - Acute neurological presentations
- RC 217 - Chest emergencies
- RC 317 - New technologies in emergency imaging

### **E<sup>3</sup> - Advanced Courses: Artificial Intelligence**

- E<sup>3</sup> 122 - Artificial intelligence (AI) in radiology: the basics you need to know
- E<sup>3</sup> 222 - Artificial intelligence for image reconstruction: towards deep imaging?
- E<sup>3</sup> 322 - Artificial intelligence and translations to clinical practice
- E<sup>3</sup> 422 - Radiomics: principles and applications
- E<sup>3</sup> 522 - Artificial intelligence and clinical decision support
- E<sup>3</sup> 622 - Challenges and solutions for introducing artificial intelligence (AI) in daily clinical workflow
- E<sup>3</sup> 722 - Making the invisible visible: pushing the boundaries in multimodality radiomic quantification



### **E<sup>3</sup> - Advanced Courses: How to Improve Your Expertise in Cardiothoracic Imaging**

- E<sup>3</sup> 919 - Low-dose thoracic CT: only screening for lung cancer?
- E<sup>3</sup> 1219 - Infections of the chest
- E<sup>3</sup> 1519 - Mediastinal and cardiac tumours in adults
- E<sup>3</sup> 1619 - Pulmonary embolism/pulmonary hypertension

### **E<sup>3</sup> - Advanced Courses: Interactive Teaching Sessions for Young (and not so Young) Radiologists**

- E<sup>3</sup> 121 - Musculoskeletal tumours
- E<sup>3</sup> 221 - Emergency and chest radiology
- E<sup>3</sup> 321 - Imaging of the liver
- E<sup>3</sup> 421 - Small bowel imaging
- E<sup>3</sup> 521 - Musculoskeletal radiology: arthropathies
- E<sup>3</sup> 621 - Neuroradiology: paediatric and adult
- E<sup>3</sup> 721 - Cardiac imaging: an update
- E<sup>3</sup> 821 - Gynecological cancer imaging
- E<sup>3</sup> 921 - Imaging of the face
- E<sup>3</sup> 1021 - Focal testicular lesions: challenging conditions
- E<sup>3</sup> 1121 - Imaging of head and neck manifestations of systemic disease
- E<sup>3</sup> 1221 - Breast lesions of uncertain malignant potential (B3 lesions): the management conundrum
- E<sup>3</sup> 1321 - Imaging of the retroperitoneum
- E<sup>3</sup> 1421 - Cross-sectional imaging of bone metastases
- E<sup>3</sup> 1521 - Pelvic pain in female patients

### **E<sup>3</sup> - Advanced Courses: Neuro**

- E<sup>3</sup> 118 - Metabolic disorders: common and complex
- E<sup>3</sup> 218 - Inflammation: the burning brain
- E<sup>3</sup> 318 - Brain tumours: new classification, new names, new challenges
- E<sup>3</sup> 418 - Vascular disorders beyond stroke: small arteries and veins
- E<sup>3</sup> 518 - Seizures: disrupted connections

### **EFOMP Workshop: New European Quality Controls for State-of-the-Art Innovations in Radiology and Artificial intelligence: The Role of the Medical Physicist**

- EF 2 - European quality controls (QC) in innovation, safety, and artificial intelligence (AI)

### **EuroSafe Imaging Sessions**

- EU 1 - Ethics and radiation protection of the patient: a focus on medical imaging
- EU 3 - Essential requirements for dose management systems (DMS): what do we really need?
- EU 4 - A historical overview of CT dose exposure: past, present, and future
- EU 7 - Medical radiation exposure of patients



E<sup>3</sup> - Rising Stars Programme: Basic Sessions

## **BS 2 - Introducing elastography**

*Organised by the EFRS*

### **Ultrasound elastography techniques**

Malene Roland Vils Pedersen; Vejle/DK

1. To explain the principles of elastography technique in US.
2. To discuss the advantages and disadvantages of the different types of elastography techniques in US.
3. To provide practical tips and tricks in the application of the technique

### **MRI elastography techniques**

Claude Portanier Mifsud; Msida/MT

1. To explain the principles of elastography technique in MRI.
2. To discuss advances in MR elastography.
3. To provide practical tips and tricks in the application of the technique.

### **Clinical applications of elastography**

Allison McGee; Dublin/IE

1. To indicate clinical areas for elastography examinations.
2. To indicate clinical indications of elastography examinations.
3. To consider the associated risks of elastography techniques

## **BS 3 - Radiation dose and image quality optimisation**

*Organised by the EFRS*

### **Patient shielding in diagnostic radiography: is it effective?**

Nejc Mekis; Ljubljana/SI

1. To explain the difference between in-plane and out-of-plane shielding.
2. To explain the pros and cons of shielding.
3. To provide an updated overview of position statements on shielding.

### **Principles of radiation dose optimisation**

Joana Santos; Coimbra/PT

1. To emphasise the need for radiation dose optimisation.
2. To discuss the role of diagnostic reference levels (DRLs) in the dose optimisation strategy.
3. To understand the importance of radiation dose monitoring.

### **Image quality evaluation methods**

Mark F. McEntee; Cork/IE

1. To provide an overview of image quality requirements in diagnostic imaging.
2. To become familiar with the available image quality assessment methods.
3. To become aware of appropriate image quality analysis.



## **BS 4 - Equality, diversity, and inclusion (EDI) issues for radiography**

*Organised by the EFRS*

### **An introduction to the concept**

Marie Stanton; Dublin/IE

1. To introduce the Athena Swan.
2. To understand the importance of the Athena Swan for radiography.
3. To emphasise how the Athena Swan can impact positively on radiography training centres.

### **Application within radiography curricula**

Ruth Strudwick; Ipswich/UK

1. To incorporate EDI in radiography curricula.
2. To discuss EDI considerations, including clinical skills labs and clinical.
3. To demonstrate the impact on the student code of conduct.

### **Ensuring appropriate patient care in the clinical environment**

Amanda Bolderston; Edmonton, AL/CA

1. To discuss EDI policies in the clinical environment.
2. To understand the requirements of CPD to support clinical radiographers and appreciate the topic.
3. To safeguard patient rights.

## **BS 5 - Radiography: raising the profile of our profession**

*Organised by the EFRS*

### **Being a professional: the EFRS perspective and why it matters**

Jonathan McNulty; Dublin/IE

1. To discuss radiography as a profession.
2. To understand the importance of being a professional.
3. To be aware of the EFRS perspective of radiographers as professionals.

### **Using social media to inform others about our profession**

Graciano Paulo; Coimbra/PT

1. To provide an overview of what social media is, what is available, and how to identify which is the best for promoting the profession.
2. To learn how to maximise social media use in promoting radiography amongst health professionals.
3. To learn how to maximise social media use in promoting radiography amongst the general public.

### **A patient's perspective on highlighting the role of radiographers**

Charlotte Beardmore; London/UK

1. To discuss the relevance of the radiographer's role within the health care system.
2. To highlight issues patients may have in distinguishing between radiology and radiography.
3. To discuss whether the radiographer's responsibility is in satisfying the patient's expectations.



## **BS 6 - Abdominal viscera: liver imaging**

*Organised by the ESR*

### **Benign liver lesions**

Andrea Laghi; Rome/IT

1. To present current imaging techniques for evaluation of benign liver lesions.
2. To describe the typical features of benign liver lesions.

### **Malignant liver lesions**

Ioana G. Lupescu; Bucharest/RO

1. To present the current imaging techniques for evaluation of malignant liver lesions.
2. To become familiar with the typical findings of malignant liver lesions.

### **MRCP: state-of-the-art diagnosis of the biliary system**

Marc Zins; Paris/FR

1. To present technical aspects and indications of MRCP.
2. To become familiar with the typical MRCP findings in benign and malignant biliary diseases.

## **BS 7 - Genitourinary**

*Organised by the ESR*

### **Imaging of the uterus**

Riccardo Manfredi; Rome/IT

1. To learn about the uterine anatomy.
2. To present the current imaging techniques for the evaluation of the uterus.
3. To demonstrate the most important findings of common uterine pathologies.

### **Imaging of the adnexa**

Sanja Stojanovic; Novi Sad/RS

1. To learn about the adnexa anatomy.
2. To present the current imaging techniques for the evaluation of the adnexa.
3. To demonstrate the most important findings of adnexal pathologies.

### **Imaging gynaecological and obstetric emergencies**

Rosemarie Forstner; Salzburg/AT

1. To present current imaging techniques for the evaluation of gynaecological and obstetric emergencies.
2. To illustrate the imaging features in gynaecological and obstetric emergencies.



## **BS 9 - Cardiovascular imaging**

*Organised by the ESR*

### **Acute coronary artery syndrome**

Charles Peebles; Southampton/UK

1. To present current imaging techniques to evaluate the coronary arteries.
2. To demonstrate the most important imaging findings.

### **Imaging in non-ischaemic cardiomyopathy**

Jens Bremerich; Basle/CH

1. To present the imaging techniques to evaluate the myocardium.
2. To demonstrate the most important findings.

### **Aortic dissection**

Karl-Friedrich Kreitner; Mainz/DE

1. To present the imaging techniques to evaluate the aorta.
2. To demonstrate the most important findings.

## **BS 10 - Neuroradiology**

*Organised by the ESR*

### **Stroke**

E. Turgut Tali; Ankara/TR

1. To learn about imaging features in haemorrhagic stroke.
2. To learn about imaging features in ischaemic stroke

### **Infection and demyelinating diseases**

Laura Oleaga Zufiría; Barcelona/ES

1. To learn about imaging features in brain infections.
2. To learn about imaging features in demyelinating diseases.

### **Tumours**

Marion Smits; Rotterdam/NL

1. To learn about imaging features in benign tumours.
2. To learn about imaging features in neoplastic disorders.



## **BS 12 - Radiologic anatomy: abdomen**

*Organised by the ESOR*

### **Small bowel**

Stuart A. Taylor; London/UK

1. To appreciate the embryological development of the small bowel.
2. To learn about the anatomy of the small bowel relevant to radiological imaging.
3. To understand the pitfalls of the normal small bowel appearance during imaging interpretation.

### **Anorectal**

András Palkó; Szeged/HU

1. To review the normal anatomy of the anorectum.
2. To learn how well depicted the different anatomical landmarks of the anorectum are with different available imaging methods.
3. To discuss the clinical scenarios for which it is necessary to be aware of the anatomy of the anorectum.

### **Peritoneum and mesentery**

Panos K. Prassopoulos; Thessaloniki/GR

1. To review the radiologic anatomy of peritoneal ligaments, mesenteries, and omenta on cross-sectional imaging.
2. To describe the most clinically important peritoneal compartments and fluid collections.
3. To discuss the key role of anatomy in the dissemination of malignancies or the restriction of inflammatory processes in the abdomen.



E<sup>3</sup> - The Beauty of Basic Knowledge: Breast

## **E<sup>3</sup> 24A - Basics of mammography**

### **Cookbook for image analysis and interpretation**

Anne Tardivon; Paris/FR

1. To learn to assess mammographic image quality and mammographic breast density.
2. To recognise and name the main imaging findings using the breast imaging reporting and data system (BIRADS) lexicon.

### **Differences in mammography techniques and image analysis**

Sophia Zackrisson; Malmö/SE

1. To learn about the technique and purpose of tomosynthesis compared to digital mammography.
2. To understand the differences in reading a screening and diagnostic mammography.
3. To become familiar with work-up possibilities after a positive screening mammography, taking into account psychological consideration.

## **E<sup>3</sup> 24C - Basics of breast MRI**

### **When is breast MRI indicated and what protocol to use?**

Ritse M. Mann; Nijmegen/NL

1. To become familiar with the guidelines for accepted indications of breast MRI.
2. To learn the basic protocol for screening and diagnostic breast MRI.

### **How to read breast MRIs**

Federica Pediconi; Rome/IT

1. To understand morphological and kinetic findings.
2. To learn the value of diffusion-weighted imaging.
3. To learn about reporting by using the breast imaging reporting and data system (BIRADS).

## **E<sup>3</sup> 24D - Basics of interventional breast imaging**

### **Ultrasound-guided interventional imaging: when and how?**

Mary C. Mahoney; Cincinnati, OH/US

1. To learn about cyst aspiration and biopsy techniques.
2. To understand the contraindication and complications.
3. To understand the correlation between imaging and pathology.

### **When and how to biopsy under mammographic guidance?**

Dragana Djilas-Ivanovic; Sremska Kamenica/RS

1. To learn about the techniques and limitations.
2. To become familiar with the quality control of stereotactic- or tomosynthesis-guided breast biopsy.

### **When and how to biopsy under MRI guidance?**

Pascal A.T. Baltzer; Vienna/AT

1. To learn about the techniques and limitations.
2. To become familiar with the quality control of MRI-guided breast biopsy.

## **E<sup>3</sup> 24E - How to deal with common clinical breast symptoms**

### **The acute painful breast**

Mihai Lesaru; Bucharest/RO

1. To learn about the choice of imaging modality.
2. To understand the management options and treatment of common breast lesions causing pain, including mastitis.

### **How to manage nipple discharge**

Isabelle Thomassin-Naggara; Paris/FR

1. To identify causes of nipple discharge unrelated to the breast or physiology.
2. To learn about the choice and sequence of imaging modalities to identify breast lesions causing nipple discharge.
3. To understand the spectrum of common benign and malignant breast lesions in relation to nipple discharge.



E<sup>3</sup> - The Beauty of Basic Knowledge: Understanding MRI Technique and MRI Safety

## **E<sup>3</sup> 25B - Static magnetic fields**

### **MRI at high-field strengths: advantages and clinical challenges**

Klaus Scheffler; Tübingen/DE

1. To get familiar with the advantages when moving to higher field strength.
2. To know the clinical benefits of higher field strengths.
3. To understand the challenges of higher field strengths.

### **MRI safety: risks with static magnetic fields**

Jacques Felbinger; Lyon/FR

1. To understand the risks of attraction for ferromagnetic material.
2. To understand the risks of torque for ferromagnetic material.
3. To understand how the manufacturer evaluates medical devices in MRI conditions.

## **E<sup>3</sup> 25C - Time varying electromagnetic fields**

### **Coils: important players in MRI**

Franz Schmitt; Erlangen/DE

1. To understand the difference between transmit and receive coils.
2. To understand why local receive coils provide a better image quality, i.e. signal-to-noise ratio.
3. To understand the importance of local multi-receive coils for accelerated MRI.

### **MRI safety: risks with high frequency and gradient fields**

Siegfried Trattnig; Vienna/AT

1. To learn about the risks associated with high frequency field, in particular the different types of burns.
2. To learn how to avoid high frequency burns in clinical MRI examinations.
3. To understand the risks of peripheral nerve stimulation and how to avoid them.

## **E<sup>3</sup> 25D - MRI in the presence of implants**

### **Sequence techniques and protocols**

Reto Sutter; Zurich/CH

1. To recognise the common types of metal-induced artifacts in MRI and to identify the diagnostic pitfalls.
2. To apply effective basic techniques for reducing MRI metal artifacts in turbo spin echo sequences and fat saturated sequences.
3. To learn about the advanced techniques reducing through-plane distortions in MRI and their clinical impact.

### **MRI implant safety assessments**

Nadia Oberhofer; Bozen/IT

1. To understand and learn how to minimise the risk related to active electronic implants in an MRI environment.
2. To understand and learn how to minimise the risk related to passive implants in patients and staff in an MRI environment.
3. To understand the role of equipment choices in reducing the risk related to implants in an MRI environment.



## **E<sup>3</sup> 25E - Working in the MRI environment**

### **Intraoperative/interventional MRI: methods and applications**

Andreas Melzer; Leipzig/DE

1. To learn about the technological prerequisites for interventional and intraoperative MRI, including MRI systems overviews, requirements, and recommendations for safe use.
2. To become familiar with the safety of interventional and surgical devices in the MRI environment.
3. To learn about appropriate workflow and enabling equipment handling for effective and safe MRI-guided procedures.

### **MRI safety education and awareness**

Titti Owman; Lund/SE

1. To understand the importance of MRI safety education and why it must be repeated and updated regularly.
2. To clarify who needs MRI safety education, the different levels of education, and how to create an efficient and sufficient educational organisation.
3. To discuss how to improve awareness of the MRI safety risks and the necessity of reporting incidents.



E<sup>3</sup> - European Diploma Prep Sessions

## **E<sup>3</sup> 123 - Gastrointestinal and abdominal**

### **A. Hepatobiliary system**

Giuseppe Brancatelli; Palermo/IT

1. To learn the anatomy, normal variants and congenital disorders of the hepatobiliary system.
2. To become familiar with the primary and secondary imaging features of acute and chronic diffuse liver diseases.
3. To understand the causes and imaging features of benign and malignant focal liver lesions.
4. To learn the various causes and imaging features of benign and malignant diseases of the biliary tract and gallbladder.

### **B. Pancreas and spleen**

Andreas Schreyer; Brandenburg/DE

1. To understand the anatomy, normal variants and congenital disorders of the pancreas.
2. To become familiar with the causes and imaging features of benign and malignant pancreatic tumours.
3. To understand the imaging features of acute and chronic pancreatitis and its potential complications.
4. To learn the causes and imaging features of focal and diffuse splenic abnormalities.

### **C. Imaging of the gastrointestinal tract**

Siobhan A. Whitley; Bury St Edmunds/UK

1. To become familiar with the anatomy, normal variants, and congenital disorders of the gastrointestinal tract.
2. To understand the imaging features of the most commonly encountered causes of an acute abdomen.
3. To learn typical radiological manifestations of inflammatory, infective, and ischaemic bowel diseases.
4. To become familiar with the staging of tumours of the gastrointestinal tract and to understand the role of different imaging modalities in diagnosing and staging.

## **E<sup>3</sup> 223 - Neuro**

### **A. Congenital and white matter disorders of the brain**

Andrea Rossi; Genoa/IT

1. To understand the development, normal anatomy, and normal variants of the brain.
2. To become familiar with common congenital disorders of the brain and neurocutaneous syndromes.
3. To learn the imaging features and differential diagnoses of white matter disease, inflammation, and neurodegeneration.

### **B. Neurovascular disorders and trauma of the brain**

Meike Vernooij; Rotterdam/NL

1. To become familiar with the normal anatomy and normal variants of the craniocervical arterial and venous system.
2. To learn the causes and imaging features of stroke, haemorrhage, and other common vascular lesions of the brain, and their relevance to interventional neuroradiology.
3. To understand the imaging features of traumatic injury to the brain.

### **C. Tumours of the brain and spine**

Majda M. Thurnher; Vienna/AT

1. To understand the normal anatomy and normal variants of the spine, spinal cord, and nerve roots.
2. To learn about the imaging features of benign and malignant tumours of the neurocranium.
3. To become familiar with the imaging features of benign and malignant tumours of the spine.



## **E<sup>3</sup> 323 - Principles of imaging and radiation protection**

### **A. Principles of computed tomography**

Elly Castellano; London/UK

1. To understand the physical basis of image formation of computed tomography and of the physics of helical, multidetector, and dual-source CT.
2. To learn the scale of Hounsfield units and the principle of window centre and width.
3. To become familiar with modern CT technology.
4. To understand the principles of optimising CT protocols with a focus on patient dose reduction.

### **B. Principles of magnetic resonance imaging**

Dominique Sappey-Mariniere; Lyon/FR

1. To become familiar with the physical basis of image formation in MRI including the principles of pulse sequences and relaxation times.
2. To become familiar with the typical appearance of tissues, organs, and main pathological processes of the most commonly used sequences in MRI.
3. To learn typical artefacts on MRI and to discuss their respective causes.
4. To understand absolute or relative contraindications against MRI and safety issues in the MR environment with regard to patients and staff.

### **C. Radiation protection**

John Damilakis; Iraklion/GR

1. To understand the phenomena of x-ray interaction with matter and their effect on image quality and dose.
2. To provide an overview of patient and staff dosimetry in diagnostic and interventional radiology.
3. To understand the basic principles of radiation protection as outlined by the ICRP (International Commission on Radiological Protection).
4. To become familiar with the concepts and tools for dose management in radiology with regard to adult and paediatric patients.

## **E<sup>3</sup> 423 - Chest**

### **A. Fundamentals of chest imaging**

Okka Hamer; Regensburg/DE

1. To learn the anatomy, including normal "lines and stripes", of the lung parenchyma, mediastinum, and pleura, and to confidently identify these on radiographs.
2. To gain an in-depth understanding of the signs of chest radiography pathology.
3. To learn about differential diagnoses and pitfalls in chest radiography.

### **B. Inflammation of the lung**

Daria Manos; Halifax, NS/CA

1. To understand the imaging features and differential diagnoses of diffuse fibrotic lung disease.
2. To learn the common causes of acute and chronic diffuse airspace disease.
3. To become familiar with thoracic diseases in immunocompetent, and immunocompromised patients.

### **C. Lung and pleural malignancy**

Peter Beddy; Dublin/IE

1. To become familiar with the differentiation of solitary and multiple pulmonary nodules and benign and malignant neoplasms.
2. To become familiar with the imaging features of pleural malignancy.
3. To understand the role of different imaging modalities, including hybrid imaging, in diagnosing and staging neoplasms of the chest.



## **E<sup>3</sup> 523 - Musculoskeletal**

### **A. Traumatic disorders of the musculoskeletal system**

Andrew J. Grainger; Leeds/UK

1. To develop an understanding of the underlying mechanisms of injury in appendicular skeletal trauma and to correlate it with imaging findings.
2. To gain an appreciation of typical fracture patterns and their accompanying soft tissue injuries.
3. To understand the benefits and disadvantages of different imaging modalities in assessing trauma involving the skeleton and soft tissue in differing age groups.

### **B. Bone tumours**

Marc-André Weber; Rostock/DE

1. To learn about the typical imaging features of common bone tumours.
2. To understand the typical imaging features of "don't touch" lesions.
3. To become familiar with the imaging manifestations of haematological disorders.

### **C. Degenerative and inflammatory disorders of the musculoskeletal system**

Anne Cotten; Lille/FR

1. To understand the imaging presentation of degenerative disorders of the joints and to appreciate their clinical relevance.
2. To learn about the imaging features and clinical features of degenerative diseases of the spine, discs, and facet joints.
3. To become familiar with the typical imaging manifestations of infection, inflammation, and metabolic diseases of the musculoskeletal system.

## **E<sup>3</sup> 623 - Breast**

### **A. Fundamentals of mammography**

James Tanner; Cambridge/UK

1. To understand the anatomy, normal appearances, variants, and abnormalities of the female breast.
2. To become familiar with the technical aspects of diagnostic mammography, especially in regard to dose and image quality.
3. To become familiar with the principles of current practice and risk/benefit analysis in breast cancer screening.

### **B. Breast cancer diagnosis and interventions**

Tamar Sella; Jerusalem/IL

1. To learn about the differentiation of benign and malignant breast disease.
2. To understand the principles and basic application of standardised diagnostic categorisation systems such as BI-RADS® (the ACR breast imaging reporting and data system).
3. To become familiar with indications, contraindications, and technical aspects of image-guided interventional breast procedures.

### **C. Advanced imaging of the female breast**

Eva M. Fallenberg; Munich/DE

1. To understand the role of advanced imaging techniques in the evaluation of the breast.
2. To learn to use the added value of new techniques for lesion classification in mammography, ultrasound, and MRI.
3. To recognise the major imaging challenges for common indications of breast imaging.



Special Focus Sessions

### **SF 3 - The prince that was promised: status of PET/MRI after the first 10 years**

#### **Complementary information: the key to success?**

Lale Umutlu; Essen/DE

1. To appreciate the protocols that can be used for PET/MRI imaging to maximise information gained in oncology imaging.
2. To understand how the morphological and functional aspects of MRI and molecular information from PET can be synergistic to give a better outcome for oncology imaging.

#### **Impact of PET/MRI on cancer patient management: the evidence**

Onofrio A. Catalano; Boston, MA/US

1. To understand the evidence that exists for the use of PET/MRI in oncologic imaging practice.
2. To become familiar with some of the clinical indications of PET/MRI in oncological practice.
3. To appreciate potential advantages of combined PET/MRI in oncologic imaging.

#### **Prostate cancer imaging with PSMA-PET/MRI: the killer application?**

Marcus R. Makowski; Berlin/DE

1. To become familiar with the protocols that can be used with PET/MRI in prostate cancer imaging.
2. To learn about the current literature supporting the use of PET/MRI in prostate cancer.
3. To appreciate the strengths and weaknesses of PET/MRI in prostate cancer imaging.

### **SF 4 - CT-derived fractional flow reserve: hope or hype in cardiac imaging?**

#### **Fractional flow reserve: an introduction**

Ricardo P.J. Budde; Rotterdam/NL

1. To explain the basic concept of fractional flow reserve in coronary arteries.
2. To review the available techniques for CT-derived fractional flow reserve.
3. To discuss how CT-derived fractional flow reserve is done in clinical practice.

#### **CT-derived fractional flow reserve: available techniques and current clinical evidence**

Gianluca Pontone; Milan/IT

1. To learn about different solutions of FFRct.
2. To learn how FFRct can improve diagnostic accuracy.
3. To learn how the integration of FFRct in the diagnostic pathway is cost effective.

#### **CT and MRI perfusion: how do they compare?**

Fabian Bamberg; Freiburg/DE

1. To learn about the technical background of CT and MRI-based perfusion imaging.
2. To understand the differences in imaging protocols between the two approaches.
3. To become familiar with the current level of scientific evidence on the value of CT and MRI-based perfusion imaging.



## **SF 6 - Tumour profiling: established and novel MRI techniques**

### **Perfusion: neovascularisation and aggressiveness**

Vicky J. Goh; London/UK

1. To understand how DCE enables improved cancer detection by revealing microvasculature and perfusion.
2. To become familiar with quantitative analysis of signal intensity-time curves after intravenous contrast agent administration in order to reveal cancer specific perfusion-related parameters.
3. To appreciate the diagnostic potential of DCE to detect significant prostate cancer.

### **DWI: tissue architecture and cell viability**

Nickolas Papanikolaou; Lisbon/PT

1. To understand how DWI enables improved cancer detection by revealing microstructural tissue features.
2. To become familiar with quantitative analysis of signal intensity-curves dependent on b-values to reveal quantitative tissue parameters (i.e. IVIM, ADC, and kurtosis).
3. To appreciate the diagnostic potential of DWI to detect and characterise cancer.

### **CEST: protein content and cellular metabolism**

Linda Knutsson; Lund/SE

1. To understand the basic physical principles of CEST MRI.
2. To become familiar with the (patho-)biologic correlates of CEST contrast.
3. To learn about clinical applications in oncology.

### **Fingerprinting: the future of functional MR imaging**

Siegfried Trattnig; Vienna/AT

1. To understand the rf pulse design of MR fingerprinting sequences (MRF).
2. To appreciate how MRF enables the quantifying of tissue properties.
3. To appreciate clinical applications in oncology.



## **SF 14 - Chest emergencies**

### **Dyspnoea: how to approach the diagnosis of diffuse lung abnormalities on CT**

Juan José Arenas-Jiménez; Alicante/ES

1. To become familiar with the characteristic radiologic patterns on CT of diffuse lung abnormalities that can be diagnostic for a specific disease.
2. To understand the importance of the clinical and laboratory background when interpreting CT with diffuse changes in patients with acute dyspnoea.
3. To learn about how to use a proposed checklist combining clinical and radiological information to narrow the differential diagnosis in patients with acute dyspnoea and diffuse lung abnormalities on CT.

### **Non-cardiac chest pain: how to proceed?**

Johann Baptist Dormagen; 0851/NO

1. To become familiar with the clinical features and patient characteristics in acute and chronic non-cardiac chest pain (NCCP) and with common and less common causes of NCCP.
2. To understand the clues and pitfalls when imaging the chest for vascular emergencies, including dissection, pulmonary embolism, and less common non-vascular conditions in patients presenting with NCCP.
3. To appreciate the importance of different imaging modalities for differential diagnoses of NCCP.

### **Acute haemoptysis: causes and radiological treatment**

Marc-André Weber; Rostock/DE

1. To appreciate that haemoptysis can be a life-threatening pulmonary emergency with high mortality, is symptomatic of an underlying severe pulmonary disease, and requires immediate diagnosis and treatment.
2. To learn about contrast-enhanced multi-detector computed tomography with CT angiography as a diagnostic modality in cases of acute haemoptysis to gain information on the underlying pulmonary disease, bleeding site, and vascular anatomy of the bronchial arteries.
3. To understand that bronchial artery embolisation is a safe and potentially lifesaving therapy in severe haemoptysis.
4. To become familiar with the fact that false embolisation in spinal branches of bronchial arteries is the most serious complication of bronchial artery embolisation.

## **SF 16 - Risk-adjusted screening for breast cancer**

### **Methods to assess breast cancer risk**

Mireille Broeders; Nijmegen/NL

1. To become familiar with the current risk prediction models for breast cancer and their potential use in screening.
2. To understand the most important measures used to determine how well a risk model performs.
3. To learn about the ongoing research to further improve models to assess breast cancer risk.

### **Mammography-based risk prediction: the CAD2Y model**

Per Hall; Stockholm/SE

### **Risk-based breast cancer screening programme: an example for the USA**

Karla Kerlikowske; San Francisco, CA/US

1. To appreciate the differences in risk prediction for overall breast cancer risk vs intermediary breast cancer outcomes.
2. To understand how risk stratification impacts the balance of benefits and harms of screening.
3. To become familiar with risk-based screening approaches in the US.

### **Screening with MRI in women with dense breasts**

Carla van Gils; Utrecht/NL

1. To appreciate the importance of breast cancer masking in addition to breast cancer risk.
2. To become familiar with the approaches of using breast density to personalise breast cancer screening with MRI.
3. To learn about the performance of MRI in women with dense breasts and increased breast cancer risk.



## **SF 18 - Deep learning and image quality**

*Organised by ESR eHealth and Informatics Subcommittee*

### **AI-enhanced image processing: noise reduction**

Wolfram Stiller; Heidelberg/DE

1. To gain basic understanding of noise and how to measure it in radiologic imaging.
2. To learn the principles of AI-enhanced noise reduction in medical imaging.
3. To know the advantages and inconveniences of AI-enhanced noise reduction.

### **How to use deep learning to quantify/estimate image quality**

Yuko Nakamura; Hiroshima/JP

1. To understand how image quality in radiology is traditionally estimated.
2. To learn how deep learning can be used to estimate image quality.
3. To explain the advantages of using deep learning to estimate image quality.

### **AI helping to optimise dose and contrast agent application**

Christoph Hoeschen; Magdeburg/DE

1. To learn about the relationship between radiation dose, contrast medium application and image quality.
2. To understand how AI can be used to optimise dose and contrast medium application.



## **SF 23 - Organ transplantation**

### **Brain death and donor evaluation**

Ferdia Bolster; Dublin/IE

1. To obtain an overview of brain death and the clinical determination of brain death.
2. To become aware of ancillary testing in brain death with a particular focus on multimodality radiology imaging in the determination of brain death, including digital subtraction angiography, transcranial Doppler, nuclear medicine scintigraphy, computed tomography (CT) and magnetic resonance imaging (MRI), CT and MR angiography, and CT and MR perfusion.
3. To understand the role of the radiologist in the early recognition of brain death, to review some conditions that can mimic brain death/pitfalls, and to review donor evaluation.

### **Living donor evaluation: liver and kidney**

Federica Vernuccio; Palermo/IT

1. To obtain an overview of the key surgical considerations and the role of imaging for the evaluation of living liver and kidney donors.
2. To provide an outline of the optimal CT imaging protocol used in the preoperative evaluation of living liver and kidney donors.
3. To discuss the main reportable findings for the diagnostic imaging work-up of living liver and kidney donors.

### **Recipient evaluation pre- and post-Tx: liver**

Rossano Girometti; Udine/IT

1. To understand the role of preoperative imaging in selecting candidates for liver transplant.
2. To understand the role of postoperative imaging in assessing transplant-related complications.
3. To summarise the main imaging algorithms and findings in pre- and post-operative scenarios.

### **Recipient evaluation pre- and post-Tx: lung**

Marie-Pierre Debray; Paris/FR

1. To learn about the imaging features evaluated in recipients before lung transplantation and to understand those that may favour mono- or bi-pulmonary transplantation and those that may lead to exclusion from the waitlist.
2. To learn to recognise the normal imaging appearance of the lung allograft in the early phase after transplantation.
3. To obtain an overview of the imaging features of the most common complications after lung transplantation.

### **Contrast-enhanced ultrasound in the follow-up evaluation of kidney-Tx**

Dirk André Clevert; Munich/DE

1. To learn about actual indications and applications of CEUS in the follow-up after transplantation of the kidney.
2. To demonstrate better parameter settings for optimal technical results.
3. To illustrate the tips and tricks for technical and clinical successful examinations.
4. To become familiar with common transplantation pathologies of the kidney.



## **SF 24 - Oral and maxillofacial radiology**

### **Overview of salivary gland imaging with an emphasis on sialo-CBCT**

Chen Nadler; Jerusalem/IL

1. To learn about the sialography indications of salivary gland pathosis.
2. To become familiar with sialography's role in demonstrating the radiographic features of salivary gland pathosis, computer-aided diagnosis, and creating a unique aid for patient assessment and treatment.
3. To obtain an overview of ultrasound and sialaendoscopy for salivary gland diagnosis and interventional treatment.

### **Role of imaging in the diagnosis of temporomandibular joint pathology**

Tore A. Larheim; Oslo/NO

1. To appreciate normal MRI variations.
2. To become familiar with the most frequent MRI pathology (internal derangement, osteoarthritis, and inflammatory joint diseases).

### **Oral and pharyngeal swallowing dysfunction among snorers, the elderly, and stroke and head and neck cancer patients**

Eva K. Levring Jäghagen; Umea/SE

1. To learn about the results from studies of oral and pharyngeal swallowing dysfunction, assessed with videofluoroscopy among snorers and patients after stroke and head and neck cancer treatment.
2. To learn about neuromuscular injuries in the oropharyngeal area among snorers.
3. To learn about the results of neuromuscular training for the improvement of swallowing function in the elderly and patients after stroke.



State of the Art Symposium

## **SA 2 - Radiological management of polytrauma**

### **Whole-body CT in polytrauma: are we imaging properly?**

Monique Brink; Nijmegen/NL

1. To learn the importance of choosing the optimal CT imaging protocol for trauma patients.
2. To understand the differences in single and dual phase imaging.
3. To appreciate the need to detect subtle but potentially fatal injuries in polytrauma patients.

### **Contrast-enhanced ultrasound (CEUS) in the follow-up of trauma patients: does it have a role?**

Vittorio Miele; Florence/IT

1. To learn how to classify and grade solid organ injuries.
2. To become familiar with incorporating CEUS in trauma patient follow ups as an alternative to repeated CT-studies.
3. To appreciate patient selection and appropriate timing of follow up CEUSs.
4. To understand the advantages and limitations of CEUS in solid organ trauma.

### **MRI in the follow-up of solid organ injury in trauma patients**

Nupur Verma; Gainesville, FL/US

1. To understand the feasibility and usefulness of MRI in solid organ injury follow up imaging.
2. To become familiar with the suitable candidates and timeline for MRI follow up with regard to severity of organ injury.
3. To understand the limitations and challenges of interpreting traumatic lesions and assessing blood products in MRI.

### **Interventional management of abdominal vascular injuries**

Leena Lehti; Malmö/SE

1. To learn about the patient selection and interventional treatment options for splenic, hepatic and renal injuries.
2. To become familiar with the recommended treatment options for solid organ and abdominal vascular injury.
3. To understand findings that indicate change of management from conservative to IR, from IR to surgical.
4. To understand what the interventional radiologist/surgeon needs to know.



Professional Challenges Sessions

## **PC 2 - Radiology reporting in the age of computer-based interpretation**

### **From automated measurements into meaningful reports**

Peter M.A. van Ooijen; Groningen/NL

1. To learn about the integration of reporting automation.
2. To become familiar with novel reporting methodologies.
3. To understand the role of man-machine interaction in reporting.

### **Common data elements in use: a critical component for improved reporting quality**

Daniel Pinto dos Santos; Cologne/DE

1. To learn about the RSNA's and ACR's common data elements initiative.
2. To understand the differences and similarities between template-based structured reporting and the use of common data elements.
3. To appreciate the potential benefits of common data elements for clinical routine and scientific research.

### **How to provide multi-media reports**

Florian Jungmann; Mainz/DE

1. To understand how radiological reports can be enriched with information that help the clinical referrers to better capture the key messages.
2. To become familiar with the integration of schematic drawings, key images, and graphs and tables to illustrate responses in oncologic patients.
3. To learn about the challenges of implementing multi-media reports and how they can be solved.

### **The value of structured information for research and quality management**

Elmar Kotter; Freiburg/DE

1. To learn about the use of structured information in research data repositories.
2. To understand how structured information can be used for the follow-up of findings.
3. To appreciate the potential of structured reporting for peer review and double-reading.



## **PC 3 - The future of ultrasound in radiology**

*Organised by the ESR Ultrasound Subcommittee*

### **Assessing point of care in ultrasound**

Maija Radzina; Riga/LV

1. To describe the current point of care concepts, guidelines, and technical aspects.
2. To provide an overview of pathologies and indications that can be covered by point of care ultrasound.
3. To outline the difference of diagnostic and point of care ultrasound applications and training requirements.

### **Who should be performing ultrasound?**

Dirk André Clevert; Munich/DE

1. To learn about who is performing ultrasound currently.
2. To understand the new technical developments in ultrasound.
3. To appreciate the advantages of ultrasound.
4. To become familiar with the future developments.

### **What will the radiologists of the future be doing in their department?**

Paolo Ricci; Rome/IT

1. To describe the organisation of an ultrasound unit in the radiology department.
2. To define how to challenge with the new ultrasound tools and facilities.
3. To identify a good method of cooperating with non-radiologists performing ultrasound.

### **How can radiology adapt to the change to handheld devices?**

Vito Cantisani; Rome/IT

1. To update on technical developments.
2. To define the role, limitations, and possibilities.
3. To show the actual European and non-European status.



Coffee & Talk (open forum) Session

## **C 9 - Tracheobronchomalacia (TBM): optimising the diagnostic approach to this increasingly important childhood entity**

### **The role of CT in tracheobronchomalacia**

Efthymia Alexopoulou; Athens/GR

1. To learn about the indications for CT in TBM.
2. To understand optimised CT protocols.
3. To discuss the CT findings in TBM.

### **The role of MRI in tracheobronchomalacia**

Pierluigi Ciet; Rotterdam/NL

1. To learn about the indications for MRI in TBM.
2. To understand the MRI imaging protocols.
3. To discuss the MRI findings in TBM.

### **Bronchoscopy: is it the gold standard?**

Konstantinos Priftis; Athens/GR

1. To acquire basic knowledge of bronchoscopic techniques.
2. To learn about the indications and limitations for bronchoscopy of the large airways in children.
3. To learn about typical bronchoscopic findings and therapeutic interventions in children.



Refresher Courses: Abdominal and Gastrointestinal

## **RC 101 - Benign and malignant lesions in "forgotten organs"**

### **A. Imaging of the spleen**

Cäcilia S. Reiner; Zurich/CH

1. To be aware of the most common benign and malignant lesions of the spleen.
2. To know about imaging strategies and protocols involving ultrasound, CT, and MRI.
3. To know about the management of splenic lesions.

### **B. Imaging of mesentery and omentum**

Antonella Filippone; Chieti/IT

1. To understand the anatomical landmarks of the mesentery and omentum.
2. To be aware of the most common pathological findings.
3. To learn how to avoid diagnostic misinterpretation of mesentery and omentum anomalies.

### **C. Imaging of the gallbladder**

Bart J. Op de Beeck; Antwerp/BE

1. To become familiar with most common benign and malignant changes of the gallbladder.
2. To be aware of the strengths and shortcomings of different imaging techniques including ultrasound, CT, and MRI.
3. To understand diagnostic pitfalls of gallbladder imaging.

## **RC 201 - Common benign and malignant liver lesions: unusual radiological appearance**

### **A. Features of benign liver lesions**

Maria Manuela França; Porto/PT

1. To be able to identify the most common benign liver lesions.
2. To learn about unusual appearances of benign liver tumours.
3. To develop an algorithm for correct identification of differentials.

### **B. Features of primary malignant liver lesions**

Giuseppe Brancatelli; Palermo/IT

1. To learn about the typical features and prevalence of hepatocellular carcinomas (HCCs) and cholangiocellular carcinomas (CCCs).
2. To understand why HCCs and CCCs do not always show typical imaging features.
3. To establish a strategy for differentiating atypical HCCs and CCCs from other liver tumours.

### **C. Features of liver metastases**

Asunción Torregrosa Andrés; Valencia/ES

1. To review the most frequent tumours causing.
2. To understand why liver metastases can have different imaging characteristics.
3. To become familiar with post-therapeutic changes.



## **RC 301 - Imaging of pancreatitis**

### **A. Focal pancreatitis vs adenocarcinoma**

Thomas Bollen; Nieuwegein/NL

1. To learn about the clinical markers of focal pancreatitis and adenocarcinoma.
2. To understand the difficulties in differentiating these entities.
3. To learn about follow-up strategies in non-conclusive cases.

### **B. IgG4 autoimmune pancreatitis**

Ankur Arora; Worthing/UK

1. To learn about the specific imaging characteristics of autoimmune pancreatitis.
2. To learn about the value of different imaging tool including US, CT, and MRI.
3. To be aware of imaging markers indicating therapeutic success in patients with autoimmune pancreatitis.

### **C. Imaging of chronic pancreatitis**

Giulia Zamboni; Verona/IT

1. To understand the strengths and weaknesses of different imaging tools.
2. To be aware of typical and atypical imaging findings in patients with chronic pancreatitis.
3. To learn about the pitfalls when evaluating patients with chronic pancreatitis.

### **D. Interventions in acute pancreatitis**

Michael M. Maher; Cork/IE

1. To recognise the techniques of interventions in acute pancreatitis.
2. To understand the indications of transgastral vs percutaneous drainage.
3. To learn how to avoid complications following pancreatic interventions.

## **RC 401 - Imaging of the biliary system**

### **A. Magnetic resonance cholangiopancreatography (MRCP): state of the art**

Carlos Valls; Stockholm/SE

1. To learn about the different techniques of MRCP including their advantages and disadvantages.
2. To discuss differences of MRCP at 1.5T and 3.0T.
3. To understand how to deal with pitfalls in MRCP.

### **B. Primary sclerosing cholangitis (PSC)**

Giovanni Morana; Treviso/IT

1. To be aware of the pathophysiological background of PSC.
2. To learn about typical and atypical imaging features of PSC.
3. To understand follow-up imaging strategies in patients with PSC.

### **C. Biliary drainage and stenting**

Thomas K. Helmberger; Munich/DE

1. To understand the access routes for biliary drainage and stenting.
2. To be aware of pitfalls and complications during and after biliary interventions.
3. To learn how to evaluate therapeutic control on imaging.



Refresher Courses: Breast

## **RC 202 - The radiologist and the oncoplastic surgeon: the importance of interaction for successful imaging evaluation**

### **A. Oncoplastic surgical techniques: what the radiologist needs to know**

Isabel Rubio; Spain/ES

1. To learn about the indications for oncoplastic surgery.
2. To describe the most common oncoplastic techniques, their strengths, and limitations.
3. To learn about the expected outcome and common complications after surgery.

### **B. The importance of imaging when planning oncoplastic surgery**

Laura Martincich; Candiolo/IT

1. To understand which imaging methods are most appropriate to use and when.
2. To learn which anatomical landmarks are more relevant in preoperative imaging.
3. To become updated on the latest imaging protocols.

### **C. Follow-up imaging of the oncoplastic breast: pearls and pitfalls**

Silvia Perez Rodrigo; Madrid/ES

1. To understand which imaging methods and which intervals should be used for follow-up.
2. To learn about the most common false-positive and false-negative imaging findings.
3. To understand the role of imaging in follow-up and prognosis.

## **RC 302 - Interventional breast imaging: the increasing role of the radiologist**

### **A. Fine-needle aspiration cytology (FNAC), core-needle, or vacuum-assisted biopsy (VAB): what, when, and how?**

Andrew Evans; Dundee/UK

1. To get to know the different needle systems.
2. To become familiar with the potential pitfalls.
3. To be able to choose the right needle for the right indication.

### **B. Breast lesion localisation: going beyond wires**

Maja Marolt Music; Ljubljana/SI

1. To appreciate the importance of image-guided preoperative wire localisation for non-palpable lesions.
2. To get to know alternative localisation techniques.
3. To become familiar with the limitations of different techniques.

### **C. Percutaneous ablation of breast cancer: a step forward**

Giovanni Mauri; Milan/IT

1. To become familiar with the different techniques for tumour ablation.
2. To acknowledge the value of each technique for the treatment of breast lesions.
3. To identify the factors that affect success.



## **RC 402 - Update on lesions with uncertain malignant potential (B3)**

### **A. A wrap-up of the newest literature on the most important B3 lesions**

Zsuzsanna Varga; Zurich/CH

1. To learn about the biological behaviour of the most important B3 lesions.
2. To understand the difference between B3a and B3b lesions.
3. To recognise the most worrisome entities.

### **B. Imaging lesions of uncertain potential**

Anna Linda; Udine/IT

1. To become familiar with the most common imaging findings in B3 lesions.
2. To identify the most appropriate imaging modality.
3. To identify the factors that limit patient compliance to the management recommendations of high-risk breast lesions.

### **C. How to handle them: update on B3 guidelines**

Nisha Sharma; Leeds/UK

1. To learn about the most recent international recommendations on the management of B3 lesions.
2. To differentiate between the results of a core-needle and a vacuum-assisted biopsy (VAB).
3. To be able to identify cases when VAB excision may pose a valid alternative to surgery.

## **RC 502 - State of the art and recent developments in breast ultrasound**

### **A. Breast ultrasound: tell me the value of coloured images**

Corinne S. Balleyguier; Villejuif/FR

1. To learn about the correct settings and interpretation of Doppler and elastography.
2. To understand their respective added value in lesion assessment.
3. To learn about their roll in follow-up and therapy monitoring.

### **B. Automated breast ultrasound (ABUS): the right add-on in screening dense breasts**

Athina Vourtsis; Athens/GR

1. To learn how to perform, assess image quality, interpret, and recognise artefacts.
2. To review the current literature of ABUS in women with dense breasts.
3. To understand the value of 3D multiplanar images and ABUS workflow implementation compared to handheld US (HHUS).

### **C. Can artificial intelligence (AI) be helpful in the US-screening setting?**

Panagiotis Kapetas; Vienna/AT

1. To understand the current status of the use of AI in US breasts screening.
2. To realise the limitations in the implementation of AI in US examinations.
3. To explore potential future applications.



Refresher Courses: Cardiac

## **RC 103 - Imaging the complexity of pulmonary hypertension (PH) "syndrome"**

### **A. Assessment of PH by CT**

Elena Mershina; Moscow/RU

1. To review the spectrum of currently available techniques, from pulmonary angiography to CT perfusion, with spectral imaging.
2. To list typical and subtle CT imaging parenchymal and vascular features in primary and secondary diseases.
3. To review the current role of CT in the clinical guidelines for the diagnosis and treatment of pulmonary hypertension.

### **B. Uncoupling right ventricular physiology with cardiovascular magnetic resonance (CMR): from early adaptation to heart failure**

François Pontana; Lille/FR

1. To review peculiarities of right heart physiology and ventricular interdependence in pulmonary hypertension.
2. To outline early and late morpho-functional changes associated with right ventricular pressure overload.
3. To understand the primary role of CMR in the evaluation of different forms of pulmonary hypertension.

### **C. Cardiac imaging to monitor therapeutic response and predict outcome**

Jens Vogel-Claussen; Hannover/DE

1. To discuss the advances in treatment and importance of imaging to guide therapy.
2. To understand the predictive role of CT and MRI.
3. To analyse the importance and respective roles of CT and MRI to monitor response to therapy.

## **RC 403 - Cardiac imaging in special patient populations**

### **A. Cardiovascular evaluation of the pregnant patient**

Birgitta K. Velthuis; Utrecht/NL

1. To learn about the normal physiological changes of the cardiovascular system during pregnancy.
2. To understand the impact of pregnancy on existing and newly developed cardiomyopathies.
3. To learn how to use CT/MRI for a pregnant patient with an acute cardiovascular problem.

### **B. Cardiotoxicity of recreational and therapeutic drugs**

Nadine Kawel-Böhm; Chur/CH

1. To understand the effects of recreational drugs on the cardiovascular system.
2. To understand the cardiac consequences of different therapeutic agents used in oncology.
3. To establish a comprehensive CT/MRI imaging protocol for the evaluation of acute and chronically ill patients.

### **C. Systemic infection/inflammation and the heart with special considerations for imaging during a pandemic**

Marco Francone; Rome/IT

1. To understand the aetiology and pathophysiology of different forms of myocarditis.
2. To learn about the cardiovascular implication for patients during the COVID-19 pandemic.
3. To become familiar with the different CT/MRI imaging characteristics of cardiac inflammation and its prognostic implications.



Refresher Courses: Chest

## **RC 204 - Thoracic emergencies: part 2**

### **A. Emergencies in thoracic oncology**

Cornelia M. Schaefer-Prokop; Amersfoort/NL

1. To learn about various causes of dyspnoea in thoracic oncology.
2. To learn about cardiac complications of thoracic malignancies.
3. To learn how to suggest an appropriate differential diagnosis.

### **B. Haemoptysis**

Antoine Khalil; Paris/FR

1. To understand the role of multidetector CT angiography.
2. To become familiar with the anatomy of bronchial arteries.
3. To learn how to optimise the planning of endovascular interventions.

### **C. Non-ischaemic cardiac emergencies**

Christian Loewe; Vienna/AT

1. To learn how to evaluate acute pericarditis.
2. To learn how to explore patients with suspected myocarditis.
3. To learn about takotsubo features on MRIs.

### **D. Postoperative and iatrogenic complications**

Jonathan D. Dodd; Dublin/IE

1. To learn about the complications after thoracic surgery.
2. To review the complications of percutaneous interventional radiology.
3. To review illustrative cases.

## **RC 504 - Pleural disease revisited**

### **A. Pleural plaques and mimickers**

Catherine Beigelman; Lausanne/CH

1. To learn about the pathophysiology of pleural plaques.
2. To recognise typical findings and differentials on radiographs.
3. To recognise typical findings and differentials on CT.

### **B. Malignant mesothelioma**

Eva Castañer; Sabadell/ES

1. To learn when to suspect mesothelioma on radiographs.
2. To recognise imaging features highly suggestive of mesothelioma on CT.
3. To learn the role of PET-CT and MRI in diagnosing mesothelioma.

### **C. Other pleural neoplasms**

Judith Babar; Cambridge/UK

1. To learn how to differentiate pleural metastases from mesothelioma.
2. To learn how to recognise benign pleural tumours.
3. To learn about other rarer pleural malignancies.



Refresher Courses: Imaging Informatics

## **RC 105 - How to manage data: moving patients' data across hospitals, regions, and countries**

### **A. Transferring patients' data across hospitals, regions, and countries: pros and cons**

Elmar Kotter; Freiburg/DE

1. To learn the benefits and risks of patients' data sharing between centres.
2. To discuss the use of novel technologies allowing data sharing.
3. To understand the differences in data policy across hospitals and European countries.

### **B. Anonymised vs pseudo-anonymised data**

Timo De Bondt; Antwerp/BE

1. To learn basic general data protection regulation (GDPR) law concepts.
2. To appreciate the difference between anonymised and pseudo-anonymised data.
3. To understand the relevance of anonymisation and pseudo-anonymisation for clinical studies.

### **C. Management of data for research projects and clinical trials**

Daniele Regge; Turin/IT

1. To learn how to design infrastructures for big projects and multi-centre trials.
2. To appreciate the different researcher roles linked to data in clinical studies.
3. To see practical examples of success stories in research projects.

### **D. Federated learning: will artificial intelligence models travel to the images?**

Nickolas Papanikolaou; Lisbon/PT

1. To learn about the federated learning concept.
2. To discuss the benefits and risks of federated learning vs centralised repositories.
3. To observe the current technical implementations allowing for practical use of federated learning.



Refresher Courses: Hybrid, Molecular and Translational Imaging

## **RC 106 - Advancing clinical hybrid imaging**

*Organised by ESHI(MT)*

### **A. Cost-effectiveness of hybrid imaging**

Barbara M. Fischer; London/UK

1. To discuss why clinicians often consider hybrid imaging as the expensive choice.
2. To obtain knowledge of the basic concepts of health economy.
3. To present and discuss examples of cost-effectiveness studies in the use of PET/CT in oncology.
4. To evaluate how hybrid imaging may be incorporated as a cost-effective tool into routine clinical practice.

### **B. PET/MRI in clinical routine**

Vicky J. Goh; London/UK

1. To learn about the basic concepts underlying PET/MRI.
2. To understand the potential clinical advantages of combining PET and MRI.
3. To discuss how PET/MRI may find a role as a routine clinical test in the future.

### **C. PET/MRI in the context of radiation treatment**

Uulke van der Heide; Amsterdam/NL

1. To learn about the role of MRI and PET/MRI in radiation oncology.
2. To understand how MRI and/or PET/MRI can be used to monitor radiotherapy response.
3. To appreciate the role of hybrid imaging in targeting and modulating radiation therapy.



Refresher Courses: Genitourinary

## **RC 107 - Imaging of benign female pelvis**

### **A. Benign ovarian lesion characterisation**

Rosemarie Forstner; Salzburg/AT

1. To understand the role of ultrasound and MRI in the characterisation of benign ovarian lesions.
2. To learn the imaging findings that allow the radiologist to recognise a mass of ovarian origin.
3. To become familiar with the different benign ovarian entities and different histological types of benign tumours.

### **B. Unusual appearances of uterine leiomyomas**

Stefania Rizzo; Milan/IT

1. To understand the role of ultrasound and MRI in the characterisation of leiomyomas, as distinct from adenomyosis.
2. To become familiar with the different histological subtypes of leiomyomas and forms of degeneration.
3. To understand the role of MRI in distinguishing unusual leiomyomas from malignant entities.

### **C. Congenital malformations of the uterus**

Cristina Maciel; Porto/PT

1. To understand how to optimise MRI protocols for the work-up of female genital tract congenital anomalies.
2. To become familiar with the different classification of female genital tract congenital anomalies.
3. To learn how to present a reporting MRI checklist according to the specific malformation, complications and associated anomalies.

## **RC 207 - Imaging of recurrent gynaecological cancer**

### **A. Cervical and vulvar carcinoma post-therapy**

Lucia Manganaro; Rome/IT

1. To become familiar with MRI expected pelvic changes after cervical and vulvar carcinoma treatment.
2. To be aware of the possible complications associated with treatment.
3. To learn the MRI features of recurrent cervical and vulvar carcinoma in the pelvis, in lymph nodes and of distant metastatic disease.

### **B. Accessing recurrent endometrial cancer**

Milagros Otero García; Vigo/ES

1. To become familiar with MRI expected pelvic changes after endometrial carcinoma treatment.
2. To be aware of the possible complications associated with endometrial carcinoma treatment.
3. To learn the MRI features of recurrent endometrial carcinoma in the pelvis, in lymph nodes, and of distant metastatic disease.

### **C. Recurrent ovarian cancer**

Andrea G. Rockall; London/UK

1. To learn the indications and techniques for follow-up imaging in ovarian cancer.
2. To recognise the appearances and pitfalls of recurrent ovarian cancer on CT.
3. To become familiar with the appearances of recurrent ovarian cancer on MRI.



Refresher Courses: Head and Neck

## **RC 108 - Imaging of 'glands' in the head and neck**

### **A. Lacrimal gland**

Ata Siddiqui; London/UK

1. To review the anatomy of the lacrimal glands and their structure.
2. To consider how best to image the lacrimal glands.
3. To become acquainted with common lacrimal gland pathology and imaging features.

### **B. Salivary gland**

Roberto Maroldi; Brescia/IT

1. To become familiar with salivary gland anatomy and structure.
2. To learn how best to image these glands and indications for different modalities.
3. To review common salivary gland pathologies and their imaging features

### **C. TI-RADS: solving the pitfalls**

Steve Colley; Birmingham/UK

1. To review the TI-RADS classification system.
2. To learn about pitfalls and issues associated with it.
3. To understand how to overcome these and develop logical imaging strategies.

### **D. Parathyroid**

Jenny Hoang; Baltimore, MD/US

1. To review the anatomy and location of parathyroid glands.
2. To become familiar with available imaging modalities and understand which to use and when.
3. To learn about common pathologies and imaging features.



## **RC 308 - Imaging of head and neck trauma**

### **A. Facial trauma**

Elizabeth Loney; Halifax/UK

1. To consider a simplified approach to reporting facial trauma scans.
2. To understand differing types of Le Fort fractures and key imaging review areas.
3. To become acquainted with mandibular fractures, types, and complications.

### **B. Laryngeal trauma**

Minerva Becker; Geneva/CH

1. To become familiar with the causes of laryngeal trauma and classification systems.
2. To learn how best to image the larynx in such situations and the challenges that can occur.
3. To review the imaging features of laryngeal trauma and consider its complications.

### **C. Orbital trauma**

Pim De Graaf; Amsterdam/NL

1. To review the relevant orbital anatomy.
2. To understand how best to image orbital trauma.
3. To consider the relevant imaging findings in the acute and chronic setting.

### **D. Skull base trauma**

Stephen Connor; London/UK

1. To briefly review the relevant skull base anatomy.
2. To understand the types and locations of traumatic injuries to the skull base.
3. To consider how to image such patients and how to review the imaging findings in acute trauma and of associated sequelae.

## **RC 408 - Granulomatous disease and its mimics in the head and neck**

### **A. Infectious granulomatous disease**

Salman Qureshi; Doha/QA

1. To review the causes of infectious granulomatous disease.
2. To reflect on the available imaging modalities and to describe the pros and cons of each.
3. To become familiar with the imaging features of such conditions in the head and neck.

### **B. Non-infectious granulomatous disease**

Soraya Robinson; Vienna/AT

1. To become familiar with non-infectious granulomatous conditions in the head and neck.
2. To learn how best to image these conditions.
3. To review the imaging features of such pathologies.

### **C. Granulomatous disease mimics**

Gitta Madani; London/UK

1. To consider the spectrum of diseases which may mimic granulomatous conditions.
2. To discuss the optimal imaging pathways.
3. To review the imaging appearances of such pathology and how reflect on how they might be differentiated from other conditions.



Refresher Courses: Musculoskeletal

## **RC 210 - Musculoskeletal imaging in rheumatology**

### **A. Crystal arthropathies**

Monique Reijnierse; Leiden/NL

1. To describe the imaging findings of crystal arthropathies.
2. To learn about differentials, choice of modalities, and possible clinical consequences of crystal arthropathies.

### **B. MRI of inflammatory diseases of the spine and sacroiliac joints**

Anne Cotten; Lille/FR

1. To describe the MRI findings of inflammatory diseases in the axial skeleton.
2. To learn about differentials of inflammatory diseases of the axial skeleton.

### **C. Joint inflammation in children and adolescents**

Nele Herregods; Ghent/BE

1. To explain the imaging and diagnostic considerations in inflammatory arthropathies in children and adolescents, including the choice of modalities.
2. To list the imaging findings and differentials in inflammatory arthropathies in children and adolescents.

## **RC 310 - The unstable joint**

### **A. Shoulder instability**

Klaus Wörtler; Munich/DE

1. To describe the morphological and epidemiological aspects of shoulder instability.
2. To explain new trends in the imaging of shoulder instability.

### **B. Elbow instability**

Reto Sutter; Zurich/CH

1. To describe the imaging features of acute elbow dislocations.
2. To explain the imaging hallmarks of chronic elbow instability.

### **C. Joint instability of the lower extremities**

Maria Tzalonikou; Athens/GR

1. To explain the imaging findings of hip and knee dislocations.
2. To describe the imaging findings of ankle instability.



## **RC 410 - My top three tips for musculoskeletal ultrasound imaging**

### **A. My top three tips for ultrasound of the shoulder**

Magdalena S. Posadzy; Poznan/PL

1. To explain the utility of standardised views.
2. To describe how to recognise common pathologies.
3. To list pitfalls and explain how to avoid them.

### **B. My top three tips for ultrasound of the elbow**

Hussain Al-Balushi; Ireland/IE

1. To explain the utility of standardised views.
2. To describe how to recognise common pathologies.
3. To list pitfalls and explain how to avoid them.

### **C. My top three tips for ultrasound of the wrist and hand**

Elena E. Drakonaki; Iraklion/GR

1. To explain the utility of standardised views.
2. To describe how to recognise common pathologies.
3. To list pitfalls and explain how to avoid them.

### **D. My top three tips for ultrasound of the hip**

Eoin C. Kavanagh; Dublin/IE

1. To explain the utility of standardised views.
2. To describe how to recognise common pathologies.
3. To list pitfalls and explain how to avoid them.

### **E. My top three tips for ultrasound of the knee**

Amanda Isaac; London/UK

1. To explain the utility of standardised views.
2. To describe how to recognise common pathologies.
3. To list pitfalls and explain how to avoid them.

### **F. My top three tips for ultrasound of the ankle and foot**

Carlo Martinoli; Genoa/IT

1. To explain the utility of standardised views.
2. To describe how to recognise common pathologies.
3. To list pitfalls and explain how to avoid them.



## **RC 510 - MRI of the knee**

### **A. ACL injury: associated soft tissue injuries**

Patrick Omoumi; Lausanne/CH

1. To explain the mechanism of an ACL tear, focusing on the associated soft tissue injuries to the menisci, posteromedial, and posterolateral corners.
2. To describe the MRI appearances of associated soft tissue injuries, their clinical importance, and potential pitfalls.

### **B. ACL repair: MRI of a normal graft and the complications**

Andreas Heuck; Munich/DE

1. To describe the normal anatomy and MRI appearances of an ACL repair by graft surgery.
2. To explain the imaging appearances of normal maturation and pathological conditions involving ligament repair.
3. To list the most valuable imaging findings that correlate with clinical complications.

### **C. Anterior knee pain**

P. Diana Afonso; Lisbon/PT

1. To describe the normal anatomy and MRI appearances of the anterior knee structures, including the extensor mechanism, fat pads, and synovial plicae.
2. To explain the imaging appearances of pathological conditions that present with anterior knee pain.

### **D. Image-guided interventions around the knee**

Catherine McCarthy; Oxford/UK

1. To describe the different imaging modalities that can be used and their advantages.
2. To explain different conditions that benefit from image-guided interventions around and within the knee.
3. To list which structures and mistakes to avoid.

## **RC 610 - Musculoskeletal tumours**

### **A. Bone tumours and tumour-like conditions**

Paul O'Donnell; Stanmore/UK

1. To learn about the imaging findings of bone tumours.
2. To describe how to differentiate benign from malignant bone lesions.

### **B. Soft tissue tumours**

Alberto Bazzocchi; Bologna/IT

1. To explain the imaging findings of soft tissue tumours.
2. To describe differential diagnostic considerations in imaging soft tissue tumours.

### **C. Tumours of the spinal column**

Filip M.H.M. Vanhoenacker; Antwerp/BE

1. To explain the imaging findings of spinal tumours.
2. To describe differential diagnostic considerations in imaging spinal tumours.



## **RC 710 - Musculoskeletal infection**

### **A. Imaging osteomyelitis: an update**

Jan Fritz; Baltimore, MD/US

1. To describe the role of imaging in diagnosing osteomyelitis.
2. To explain the role of intravenous contrast medium material in diagnosing osteomyelitis.
3. To list the differential diagnostic considerations in imaging osteomyelitis.

### **B. Soft tissue infections**

Silvia Martin; Palma de Mallorca/ES

1. To describe the role of imaging in soft tissue infections.
2. To explain the role of intravenous contrast medium material in diagnosing soft tissue infections.
3. To list the differential diagnostic considerations in imaging soft tissue infections.

### **C. Septic arthritis**

Radhesh Lalam; Oswestry/UK

1. To describe the role of imaging in septic arthritis.
2. To explain the role of intravenous contrast medium material in diagnosing septic arthritis.
3. To list the differential diagnostic considerations in imaging septic arthritis.

## **RC 810 - Essential measurements and classifications in musculoskeletal joint imaging**

### **A. Shoulder**

Ustun Aydingoz; Ankara/TR

1. To describe essential measurements and classifications that need to be made in shoulder imaging.
2. To explain how these measurements/classifications relate to pathophysiology and management-related decision making.

### **B. Elbow-wrist-hand**

Milko C. De Jonge; Utrecht/NL

1. To describe the essential measurements and classifications that need to be made in elbow, wrist, and hand imaging.
2. To explain how these measurements/classifications relate to pathophysiology and management-related decision making.

### **C. Hip**

Florian Schmaranzer; Berne/CH

1. To describe the essential measurements and classifications that need to be made in hip imaging.
2. To explain how these measurements/classifications relate to pathophysiology and management-related decision making.

### **D. Knee**

Christoph Rehnitz; Heidelberg/DE

1. To describe the essential measurements and classifications that need to be made in knee imaging.
2. To explain how these measurements/classifications relate to pathophysiology and management-related decision making.

### **E. Ankle-foot**

Maryam Shahabpour; Brussels/BE

1. To describe essential measurements and classifications that need to be made in ankle and foot imaging.
2. To explain how these measurements/classifications relate to pathophysiology and management-related decision making.



Refresher Courses: Neuro

## **RC 111 - Craniocervical junction**

### **A. Congenital abnormalities**

Andrea Rossi; Genoa/IT

1. To become familiar with the congenital bone anomalies and variants of the craniocervical junction.
2. To learn about associated cerebellar and spinal cord abnormalities.
3. To illustrate craniocervical anomalies in syndromes.

### **B. Trauma**

Ashok Adams; London/UK

1. To be able to categorise the spectrum of fractures.
2. To develop an understanding of the biomechanics and management options.
3. To appreciate the imaging findings in ligamentous craniocervical injuries.

### **C. Systemic diseases and tumours**

Karl-Olof Løvblad; Geneva/CH

1. To recognise craniocervical injuries in rheumatoid arthritis.
2. To differentiate systemic diseases from other pathology involving the craniocervical junction.
3. To become familiar with retro-odontoid pseudotumours without rheumatoid arthritis.

## **RC 211 - Sellar and parasellar lesions**

### **A. Anatomy, variants, and function of the pituitary gland**

Seamus Looby; Dublin/IE

1. To review the anatomy of the sellar and parasellar region.
2. To recognise sellar variants.
3. To be able to appropriately image the patient with diabetes insipidus.

### **B. Imaging of sellar and suprasellar lesions**

Zoran Rumboldt; Rovinj-Rovigno/HR

1. To recognise pituitary and sellar neoplasms other than adenoma.
2. To describe perisellar and suprasellar pathology.
3. To provide an overview of sellar and suprasellar childhood lesions.

### **C. Post-treatment findings and follow-up**

Fabrice Bonneville; Toulouse/FR

1. To become familiar with the different types of pituitary adenoma.
2. To define the most effective imaging strategy for pituitary adenoma.
3. To learn about the role of MRI after surgical and/or medical treatment.



## **RC 311 - Neuromuscular imaging**

### **A. How to image patients with neuromuscular disease**

Marc-André Weber; Rostock/DE

1. To become aware of the recent developments in muscle imaging.
2. To understand the role of imaging in muscle atrophy.
3. To become familiar with the expectations of the neurologist.

### **B. How to report congenital myopathies**

Anna Pichiecchio; Pavia/IT

1. To appreciate muscle MRI findings in neuromuscular disorders.
2. To learn about structured reporting in neuromuscular diseases.
3. To understand the role of various imaging modalities in the workup of congenital myopathies.

### **C. How to recognise adult neuromuscular disease**

Sachit Shah; London/UK

1. To learn how to apply the optimal imaging protocol.
2. To appreciate the role of quantitative imaging in genetic and acquired myopathies.
3. To illustrate the role of brain imaging in neuromuscular disorders.

## **RC 411 - Aging brain imaging: essential clues for diagnosis**

### **A. Brain aging: what is normal?**

Meike Vernooij; Rotterdam/NL

1. To understand the importance for radiologists to have knowledge on the process of brain aging.
2. To learn what is 'normal' and what is considered 'abnormal' aging in brain imaging.
3. To illustrate how this knowledge can be incorporated into reading and reporting brain scans in clinical practice.

### **B. Imaging of abnormal cognitive deterioration: Alzheimer's and beyond**

Alexandre Krainik; Grenoble/FR

1. To understand the relationships between imaging features and memory, executive, and speech impairments.
2. To learn how to recognise abnormal brain imaging features and patterns useful for clinical practice.
3. To provide essential clues for reporting atrophy, grey, and white matter abnormalities.

### **C. Imaging of abnormal motor deterioration: Parkinson's and beyond**

Sven Haller; Geneva/CH

1. To understand the pathophysiology of the main extrapyramidal syndromes and neurodegenerative diseases.
2. To learn how to recognise related brain imaging abnormalities.
3. To provide essential clues for reporting and discussing differential diagnoses.



## **RC 611 - Cerebrospinal fluid (CSF) and glymphatic system imaging**

### **A. How to identify Virchow-Robin spaces and glymphatic system disorders**

Nivedita Argawal; Trento/IT

1. To understand the pathophysiological disorders of Virchow-Robin spaces.
2. To learn how to optimise glymphatic system imaging.
3. To be able to report enlarged perivascular spaces.

### **B. How to diagnose cerebrospinal fluid deficit**

Chrysa Tziakouri-Shiakalli; Nicosia/CY

1. To understand the pathophysiology of CSF production.
2. To recognise malformations of cortical development.
3. To learn how to report malformations of cortical development.

### **C. How to report cerebrospinal fluid excess**

Joanna Bladowska; Wroclaw/PL

1. To understand the pathophysiology of CSF circulation.
2. To be able to diagnose the different types of CSF excess.
3. To understand the relationships between CSF excess and intracranial hypertension.



Refresher Courses: Paediatric

## **RC 112 - Learning from common errors and discrepancies in paediatric radiology**

### **A. Pitfalls to avoid in musculoskeletal imaging**

Susan Cheng Shelmerdine; London/UK

1. To understand how learning from mistakes improves clinical care.
2. To review common pitfalls in musculoskeletal imaging.
3. To learn how to avoid mistakes concerning bone marrow signal in children.

### **B. Pitfalls to avoid in chest imaging**

Wolfgang Hirsch; Leipzig/DE

1. To understand how learning from mistakes improves clinical care.
2. To review common pitfalls in chest imaging.
3. To learn how to avoid mistakes concerning lines and tubes.

### **C. Pitfalls to avoid in abdominal imaging**

Sophie Swinson; Leeds/UK

1. To understand how learning from mistakes improves clinical care.
2. To review common pitfalls in abdominal imaging.
3. To learn how to avoid mistakes in patients with acute abdominal pain.

### **D. Pitfalls to avoid in neuroimaging**

Andrea Rossi; Genoa/IT

1. To understand how learning from mistakes improves clinical care.
2. To review common pitfalls in neuroimaging.
3. To learn how to avoid mistakes concerning ventricles and subarachnoid spaces.



## **RC 212 - Imaging the small ones: tips and tricks in neonatal imaging**

### **A. Neuroimaging in the neonate**

Catherine Adamsbaum; Le Kremlin-Bicêtre/FR

1. To learn the most common neurological queries in neonatology.
2. To understand the technical challenges of US and MRI in neonatal imaging.
3. To discuss the key findings that may be useful for differential diagnosis.

### **B. Neonatal renal dilatation**

Jim Carmichael; London/UK

1. To learn how to investigate antenatal renal dilatation.
2. To understand congenital abnormalities leading to renal dilatation and how to investigate them.
3. To present a protocol for investigation and follow-up of renal dilatation in the neonate.

### **C. Neonatal jaundice**

Helen Woodley; Leeds/UK

1. To understand the aetiologies of neonatal jaundice such as biliary atresia.
2. To appreciate the key features for diagnosis.
3. To discuss appropriate management.

### **D. Imaging the neonatal bowel**

Anne M.J.B. Smets; Amsterdam/NL

1. To recognise common bowel abnormalities in neonates on radiographs.
2. To learn how to use ultrasound to investigate necrotising enterocolitis and bowel perforation.
3. To discuss developmental bowel abnormalities.

### **E. Imaging lines and tubes in neonates**

Ola Kvist; Stockholm/SE

1. To appreciate the normal course of lines and tubes in neonates on radiographs.
2. To learn how to use ultrasound to assess line position.
3. To discuss the complications of lines and tubes in neonates using radiographs and ultrasound.



## **RC 412 - Imaging of frequent queries in children: an evidence-based approach**

### **A. Abdominal pain: constipation and beyond**

Ian Robinson; Dublin/IE

1. To learn about the most common causes of chronic abdominal pain in children.
2. To understand the indications for imaging and choice of imaging modalities in paediatric abdominal pain.
3. To appreciate the typical findings and 'red flag' features.

### **B. Respiratory tract infections**

Pierluigi Ciet; Rotterdam/NL

1. To learn about the role of imaging in childhood respiratory tract infections.
2. To understand the indications and limitations of radiography, CT, and ultrasound.
3. To discuss the typical radiological findings and their clinical implications in a child with a respiratory tract infection.

### **C. Large and small heads: when and how to image**

Ümit Yaşar Ayaz; Mersin/TR

1. To learn the indications for imaging in deviating head circumference.
2. To understand examination techniques and imaging algorithms.
3. To appreciate the most common pathologies and their clinical implications.

### **D. The limping child**

Ignasi Barber; Esplugues de Llobregat/ES

1. To learn about the most important differential diagnosis in a limping child.
2. To understand the indications for imaging and choice of imaging modalities in a child with a limp.
3. To appreciate the most important findings and 'red flag' features.

## **RC 512 - Polytrauma management**

### **A. US, CT, and MRI in paediatric polytrauma: when and how to use?**

Maria Raissaki; Iraklion/GR

1. To discuss the justification for imaging in paediatric polytrauma patients.
2. To learn about the imaging protocols and current guidelines in paediatric polytrauma management.
3. To discuss the potential applications and limitations of US, CT, and MRI in paediatric polytrauma patients.

### **B. Cerebral and spinal trauma in children: what the surgeon needs to know**

Annelie Slaar; Amsterdam/NL

1. To learn about the imaging patterns of cerebral and spinal trauma in children.
2. To discuss the indications for imaging in paediatric cerebral and spinal trauma.
3. To become familiar with basic and advanced imaging protocols.

### **C. Thoracic and abdominal trauma in children: what the surgeon needs to know**

Ilias Tsiflikas; Tübingen/DE

1. To learn about the imaging patterns of thoracic and abdominal trauma in children.
2. To discuss the indications for imaging in paediatric thoracic and abdominal trauma.
3. To become familiar with basic and advanced imaging protocols.



Refresher Courses: Physics in Medical Imaging

## **RC 413 - Radiation dose monitoring systems (RDMS): from commissioning to effective use**

### **A. Supply and commissioning of an RDMS to meet all your needs**

Niki Fitousi; Leuven/BE

1. To understand how to select the right system for each hospital.
2. To learn how data should be validated after being collected.
3. To understand how derived quantities are calculated.

### **B. How to manage the data and extract the relevant information**

Oswaldo Rampado; Turin/IT

1. To learn about the methods of data extraction.
2. To be able to query the database with different filters.
3. To understand how to use this data to guide optimisation actions.

### **C. Monitoring and analysis of patients with high cumulative risks**

Jenia N. Vassileva; Vienna/AT

1. To learn the strategies of defining attention levels and possible intervention thresholds.
2. To understand how to correlate cumulative dose indices with cumulative risks.
3. To evaluate which procedures and clinical pathways involve high cumulative risks.

## **RC 513 - Quantification of magnetic resonance imaging parameters in clinical practice**

### **A. Parameter mapping in MRI: acquisition methodologies**

Lars G. Hanson; Copenhagen/DK

1. To learn about available acquisition methodologies for the mapping of MRI parameters: T1, T2, T2\*, and magnetic susceptibility.
2. To understand the current limitations of different approaches in a clinical setting.
3. To be able to select suitable phantoms that assure reproducibility and accuracy when performing quantitative measures.

### **B. Towards optimisation and standardisation of MRI techniques for diffusion MRI of the body**

Marco Giannelli; Pisa/IT

1. To learn about diffusion MRI in body applications.
2. To understand how to perform quantitative diffusion MRI in body applications.
3. To evaluate the performance of different MRI techniques.

### **C. Quantitative, multi-parametric MRI as a useful biomarker in the clini**

Ferdia A. Gallagher; Cambridge/UK

1. To learn about the use of quantitative biomarkers in medical images.
2. To understand how quantification improves decision making in a clinical context.
3. To evaluate the open issues that need to be tackled to exploit such techniques fully.

Refresher Courses: Radiographers

## **RC 214 - Imaging and advanced practice in radiotherapy**

### **A. CT in radiotherapy**

Rafaela Guisantes; Coimbra/PT

1. To explain the specific radiotherapy requirements of CT simulation.
2. To understand the key principles of optimisation when performing CT simulation.
3. To be aware of the impact of patient preparation and positioning during CT simulation in the treatment planning process.

### **B. MRI in radiotherapy**

Vesna Mekis; Ljubljana/SI

1. To understand the importance of MRI simulation in the treatment planning process.
2. To explain specific radiotherapy requirements of MRI simulation and to consider the role of the MRI linear accelerator.
3. To discuss future perspectives of MRI in radiotherapy.

### **C. Advanced practice in radiotherapy**

Sue Mercieca; Msida/MT

1. To review the current advanced practice opportunities in radiotherapy.
2. To explore the potential opportunities for radiographers in radiotherapy practice.
3. To discuss the importance of education, training, and continuous professional development for radiographers specialising in radiotherapy.

## **RC 314 - Developments and practice in ultrasound**

### **A. Advances in ultrasound transducer technology**

Geert Plug; Haarlem/NL

1. To become familiar with the latest technologies in ultrasound transducer technology.
2. To explore the consequences of different transducer technologies in examination protocols.
3. To explore the use of the latest technologies in ultrasound in daily routine practice.

### **B. Technical quality management in ultrasound**

Saso Arnuga; Ljubljana/SI

1. To become familiar with technical quality management in ultrasound.
2. To outline the benefits of technical quality management in ultrasound.
3. To identify challenges and opportunities for radiographers/sonographers in implementing technical quality management.

### **C. Perspectives of radiographers performing ultrasound**

Gill Harrison; London/UK

1. To provide an overview of the radiographer/sonographer role in ultrasound.
2. To recognise the barriers to the successful implementation of radiographers performing ultrasound.
3. To explain the specific requirements of radiographers performing ultrasound.



## **RC 514 - Updates in forensic imaging**

### **A. An overview of best practice for radiographers in forensic imaging**

Ulrike Weinberger; Vienna/AT

1. To understand the key aspects of the radiographers' role in forensic imaging.
2. To discuss the importance of the continuity of evidence and record keeping during forensic examinations.
3. To highlight other elements of current best-practice guidelines.

### **B. Paediatric forensic imaging**

Niamh Kirk; Belfast/UK

1. To appreciate the role of multi-modality imaging in paediatric forensic cases.
2. To become familiar with the current guidelines on imaging in cases of suspected physical abuse/non-accidental injuries.
3. To recognise the potential challenges in obtaining cooperation from relatives.

### **C. Optimising post-mortem CT examinations and protocols**

Jeroen Kroll; Maastricht/NL

1. To explore the range of applications for CT in forensic imaging.
2. To evaluate the approaches to the optimisation of workflow in post-mortem CT.
3. To discuss tips and tricks to optimise your protocols for a range of forensic applications.



Refresher Courses: Vascular

## **RC 115 - Venous thrombotic disease**

### **A. Acute deep vein thrombosis: diagnosis, interventional radiology (IR) treatment, and outcomes**

Geert Maleux; Leuven/BE

1. To learn about the clinical symptoms and diagnosis of deep vein thrombosis (DVT).
2. To become familiar with the different conservative and IR treatment options.
3. To discuss the short-, mid-, and long-term outcomes.

### **B. Diagnosis and treatment of central venous occlusions**

Salah D. Qanadli; Lausanne/CH

1. To learn about clinical symptoms and the appropriate diagnostic tools.
2. To become familiar with which patients IR treatment is indicated.
3. To understand how to treat a central venous occlusion using IR methods.

### **C. Chronic deep vein thrombosis: diagnosis, IR treatment, and outcomes**

Romarc Loffroy; Dijon/FR

1. To learn about the clinical symptoms and diagnosis of chronic DVT.
2. To become familiar with preinterventional imaging and appropriate treatment planning.
3. To discuss different IR techniques and outcomes.



Refresher Courses: Oncologic Imaging

## **RC 116 - Peritoneal carcinomatosis: the role of imaging in detection and treatment planning?**

### **A. Detection and characterisation: tips and tricks**

Laure S. Fournier; Paris/FR

1. To become familiar with imaging strategies for the assessment of peritoneal carcinomatosis.
2. To discuss multimodal concepts for detection and characterisation.
3. To learn about the limitations of non-invasive imaging approaches.

### **B. Surgical view: cytoreductive surgery**

Anne-Sophie Bats; Paris/FR

1. To understand the surgeon's view on imaging strategies.
2. To learn about surgical strategies for the treatment of peritoneal carcinomatosis.
3. To highlight the relevant information from imaging for decision making.

### **C. Imaging in treatment planning and follow-up**

Giulia Zamboni; Verona/IT

1. To become familiar with the role of imaging for systemic and local treatment planning.
2. To discuss the value of imaging modalities.
3. To understand the limitations and pitfalls of imaging.

## **RC 316 - Role of imaging in immunotherapy: tumour response assessment and complications**

### **A. What is immunotherapy and (how) does it work?**

Clarisse Dromain; Lausanne/CH

1. To discuss the concept of immunotherapy treatment in cancer.
2. To learn the different types of immunotherapies.
3. To understand the challenges of assessing immunotherapy response.

### **B. Challenges in measuring immunotherapy response**

Thorsten Persigehl; Cologne/DE

1. To understand the limitations of RECIST and to become aware of the immune response criteria.
2. To learn about the specifics of immune-related RECIST.
3. To become familiar with pseudoprogression and hyperprogression.

### **C. Functional and molecular imaging: FDG and beyond**

Vicky J. Goh; London/UK

1. To understand the current role of [18F]FDG-PET in immunotherapy response assessment.
2. To become familiar with the concepts of Immuno-PET.
3. To learn the applications of novel Immuno-PET tracers.

### **D. Complications of immunotherapy**

Oliver Lukas Sedlacek; Heidelberg/DE

1. To learn which immunotherapies frequently lead to complications.
2. To become familiar with which life-threatening complications can be caused by immunotherapies.
3. To learn when immunotherapy-related complications commonly occur.



Refresher Courses: Emergency Imaging

## **RC 117 - Acute neurological presentations**

### **A. Acute central nervous system (CNS) infections**

Maureen Dumba; London/UK

1. To learn about imaging preferences in the setting of acute CNS infections.
2. To become familiar with the imaging features of the various CNS infections.
3. To understand the role of emergency radiology in the diagnosis and follow-up of patients with acute CNS infections.

### **B. Usual and unusual imaging findings of stroke patient**

Marwan El-Koussy; Berne/CH

1. To learn about the common imaging findings of ischaemic and haemorrhagic stroke.
2. To understand the arterial and venous causative mechanisms and become familiar with unusual imaging findings to prevent missed stroke cases.
3. To understand the 'time is brain approach' in the imaging evaluation of patients with stroke.

### **C. Neurological emergency imaging: which sequence and when?**

Danielle Byrne; Dublin/IE

1. To understand the terminology.
2. To appreciate the rationale and value of the different imaging modalities and sequences available for acute neurology.
3. To understand which imaging modality and sequence is most useful in each scenario.

## **RC 217 - Chest emergencies**

### **A. Imaging of acute chest pain**

Paola Franchi; Teramo/IT

1. To learn how acute chest pain should be assessed in emergency imaging.
2. To learn how to optimise the CT protocols.
3. To understand the main pitfalls in the imaging assessment of acute chest pain.

### **B. Infection in the lung: the role of the emergency radiologist in the management of the patient**

Catherine Beigelman; Lausanne/CH

1. To differentiate lung infection from other lung pathologies.
2. To learn about specific imaging findings of different infectious processes in the lung.
3. To learn how to differentiate bacterial, viral, and fungal infections.

### **C. Acute aortic syndrome: from imaging to management**

Ferco Henricus Berger; Toronto, ON/CA

1. To understand the different forms of acute aortic syndrome, their prognosis, and potential treatments.
2. To distinguish the high-risk features of acute aortic syndromes.
3. To learn about proper imaging protocol selection.



## **RC 317 - New technologies in emergency imaging**

### **A. New frontiers in emergency radiology: better imaging, less radiation - how to optimise dose reduction**

Mehmet Ruhi Onur; Ankara/TR

1. To describe radiation limiting strategies (including noise reducing image reconstruction algorithms, automatic tube modulation, optimum z-axis coverage) and their impact on image quality in emergency CT.
2. To explain the effect of CT scanning parameters on radiation dose and image quality and to illustrate specific radiation dose output decreasing strategies.
3. To assess the importance of CT dose monitoring and workflow by dose management systems and to be familiar with diagnostic reference levels (DRL) of CT examinations.
4. To suggest consistent solutions to common problems in emergency CT that increase radiation dose and decrease image quality.

### **B. Postprocessing CT programmes (ASPECT, cerebral blood flow imaging, cardiac function assessment programmes, lung analysis, and cinematic rendering)**

Steven P. Rowe; Baltimore, MD/US

1. To become familiar with the novel postprocessing CT imaging techniques and their contributions in the diagnosis of emergency settings, and their effect on patient management.
2. To understand the trade off between time taken for a post processing technique vs the clinical benefit in predicting the prognosis.
3. To be able to explain how techniques such as cinematic rendering can help patients and clinical staff to understand radiological findings more clearly.

### **C. Role of dual-energy CT in bone injuries**

Hatem Alkadhi; Zurich/CH

1. To review the basic technical principles of dual-energy CT for bone imaging.
2. To understand the utility of dual-energy CT in bone injury evaluation in terms of management of the patients.
3. To learn the advantages and shortcomings of dual-energy CT in patients with skeletal disease.

### **D. Utility of the clinical decision support system (CDS) in emergency radiology**

Alexander Goehler; Essen/DE

1. To learn what a CDS is and how it works.
2. To understand how a CDS can help clinicians to eliminate inappropriate investigations or procedures and adhere to the latest practice guidelines.
3. To recognise the concerns that a CDS may constrain clinical management and understand the benefits a good CDS can bring to the individual patient pathway.



E<sup>3</sup> - Advanced Courses: Artificial Intelligence

## **E<sup>3</sup> 122 - Artificial intelligence (AI) in radiology: the basics you need to know**

### **A. Conventional machine learning vs deep learning**

Marleen de Bruijne; Rotterdam/NL

1. To understand the difference between machine learning and deep learning.
2. To learn about the various conventional machine learning techniques.
3. To learn about pros and cons of conventional machine learning vs deep learning.

### **B. Training data for deep learning: what is needed?**

Ben Glocker; London/UK

1. To understand how deep learning algorithms are trained.
2. To learn about the methods of performing deep learning in cases of limited training data.
3. To understand the limits of deep learning approaches.

### **C. Clinical applications of artificial intelligence (AI) in medical imaging**

Nickolas Papanikolaou; Lisbon/PT

1. To learn about the current state of the art of AI applications in medical imaging.
2. To focus on the current challenges related to AI development and deployment in clinical conditions.
3. To understand how AI will transform medical imaging in the long term.

## **E<sup>3</sup> 222 - Artificial intelligence for image reconstruction: towards deep imaging?**

### **A. Deep learning for MRI reconstruction**

Kerstin Hammernik; London/UK

1. To demonstrate how with deep learning we can learn the entire MRI reconstruction procedure.
2. To understand the advantages and disadvantages of using deep learning in MRI reconstruction.
3. To demonstrate the application of deep learning in the reconstruction of MRI musculoskeletal images.

### **B. Deep learning in cardiac MRI acquisition and reconstruction**

Daniel Rueckert; London/UK

1. To understand how MRI acquisition time can be reduced with deep learning.
2. To understand the potential artefacts related to deep learning-based image reconstruction.
3. To demonstrate the applications of deep learning in the reconstruction of cardiovascular MRI data.

### **C. Deep learning in CT image acquisition and reconstruction**

Mathias Prokop; Nijmegen/NL

1. To learn how deep learning can be used to improve CT image quality.
2. To understand how deep learning can be used to speed up CT image acquisition.
3. To learn about clinical applications of deep learning-based CT reconstruction.



## **E<sup>3</sup> 322 - Artificial intelligence and translations to clinical practice**

### **A. Artificial intelligence (AI) use cases**

Keith J. Dreyer; Boston, MA/US

1. To introduce the audience to the AI use cases developed by the American College of Radiology.
2. To learn about an ecosystem for developing AI algorithms that can be translated into clinical practice.
3. To discuss the hurdles and proposed solutions to getting regulatory approval for AI techniques.

### **B. Challenges to objectively compare performance of AI applications**

Lena Maier-Hein; Heidelberg/DE

1. To learn about the outcomes of a review of more than 150 challenges in medical imaging.
2. To learn about the metrics allowing the objective evaluation of AI algorithm performance.
3. To understand how new developments in AI challenges help to objectively evaluate the performance of algorithms.

### **C. How far are we in getting AI into clinical practice?**

Luis Martí-Bonmatí; Valencia/ES

1. To critically review the current level of AI adoption in clinical practice.
2. To understand the need of data scientists working in radiology departments.
3. To discuss what next steps need to be taken in order to increase take-up in clinical practice.

## **E<sup>3</sup> 422 - Radiomics: principles and applications**

### **A. Radiomics: images are data!**

Giuseppe Cicchetti; Rome/IT

1. To understand the design of a pipeline to develop a radiomics signature.
2. To learn about the current state of the art in radiomics.
3. To learn about the impact of radiomics for precision medicine.

### **B. Radiomics applications**

Tobias Penzkofer; Berlin/DE

1. To learn about the state of the art of radiomics in prostate cancer.
2. To learn about the state of the art of radiomics in gliomas.
3. To learn about other promising application areas of radiomics.

### **C. Multicentre studies for more robust radiomics signatures**

Martijn Starmans; Rotterdam/NL

1. To introduce a framework for the rapid development of radiomics signatures.
2. To explain how the parameters of a radiomics pipeline can be automatically optimised.
3. To show the performance of the framework for a number of applications.



## **E<sup>3</sup> 522 - Artificial intelligence and clinical decision support**

### **A. Clinical decision support workflow improved by artificial intelligence (AI)**

Erik R. Ranschaert; Tilburg/NL

1. To learn how a decision support workflow can be supported and improved by AI.
2. To understand the different workflow parts in which AI can play a role.
3. To discuss how to evaluate the clinical value of AI in decision support.

### **B. Data mining and machine learning for integrated clinical decision support**

Giles Boland; Boston, MA/US

1. To understand how data mining can help in clinical decision support.
2. To learn about the needs and limitations of standardisation for AI-assisted clinical decision support.
3. To learn about the state of the art in AI-assisted clinical decision support.

### **C. AI to predict treatment response**

Nandita M. deSouza; Sutton/UK

1. To understand the role of AI in moving towards precision medicine.
2. To understand the current potential of AI for monitoring response.
3. To understand how to manage AI in a clinical workflow as a decision support tool.

## **E<sup>3</sup> 622 - Challenges and solutions for introducing artificial intelligence (AI) in daily clinical workflow**

### **A. Implementation of AI algorithms in picture archiving and communication systems (PACS)**

Wouter B. Veldhuis; Utrecht/NL

1. To learn about how to start experimenting with AI in daily clinical routine.
2. To learn about the developments of integrating multiple AI tools within one framework.
3. To learn about the processes to evaluate AI algorithms for clinical use cases.

### **B. How to best complement human intelligence with AI**

Christian J. Herold; Vienna/AT

1. To understand the current and emerging concept for AI and machine learning in imaging.
2. To explore whether it is possible to successfully integrate AI into clinical practice today.
3. To learn how radiologists can be assisted by AI.

### **C. AI, ethics, and radiology**

Adrian Brady; Cork/IE

1. To understand the ethical aspects related to data use in AI.
2. To learn about possible bias in AI algorithms.
3. To learn how to prepare radiology policies for AI.

### **D. AI in radiology: culture change**

Howard Fleishon; Atlanta, GA/US

1. To review the possible changes in radiology practices and departments due to the implementation of AI workflows.
2. To present the possible impact of AI on radiology macroeconomics.
3. To discuss the educational innovations in introducing AI into radiology resident training.



## **E<sup>3</sup> 722 - Making the invisible visible: pushing the boundaries in multimodality radiomic quantification**

*Jointly organised by the ESR and EIBALL*

### **A. Unravelling the mysteries of the black box: does radiomics enhance or complement biomarker data?**

Ana Jimenez-Pastor; Valencia/ES

1. To learn what radiomic analyses add to current biomarker evaluation.
2. To appreciate the limitations and pitfalls of such analyses.
3. To understand the most robust statistical methods for carrying out the analyses.

### **B. Working across modalities: how do we progress from redundant to relevant data?**

Henry Woodruff; Maastricht/NL

1. To learn how radiomic outputs differ across modalities.
2. To appreciate the variability of the method and how to ensure data is robust.
3. To understand the relevance of the findings.

### **C. Using radiomics in the clinic: a decision support tool?**

Marius E. Mayerhöfer; Vienna/AT

1. To learn the clinical scenarios where radiomic analyses may be helpful.
2. To appreciate the place of these analyses in the context of other quantifiable biomarkers.
3. To understand the implications of using these analyses in the clinic.



E<sup>3</sup> - Advanced Courses: How to Improve Your Expertise in Cardiothoracic Imaging

## **E<sup>3</sup> 919 - Low-dose thoracic CT: only screening for lung cancer?**

### **A. Overview of lung cancer screening activities in European countries**

Stefan Diederich; Düsseldorf/DE

1. To be aware of the latest results of lung cancer screening trials.
2. To learn about the best technical standards for lung cancer screening.
3. To learn about the performance of artificial intelligence algorithms for lung cancer prediction.

### **B. Lung nodule management**

Anna Rita Larici; Rome/IT

1. To be aware of the common causes of solitary pulmonary nodules.
2. To learn about key radiological features suggesting a benign cause.
3. To learn about the methods allowing identifying malignant nodules.

### **C. Coronary artery disease assessment as part of a lung cancer screening programme: how to do it?**

Rozemarijn Vliegenthart; Groningen/NL

1. To become familiar with the importance and predictive power of coronary calcium assessment.
2. To discuss the possibilities of combining coronary calcium assessment and lung cancer screening.
3. To learn about the practical implementation of coronary calcium assessment in the routine chest.

## **E<sup>3</sup> 1219 - Infections of the chest**

### **A. Pulmonary infections**

Jiri Neuwirth; Prague/CZ

1. To review the role and limitations of chest-x ray for diagnosing community-acquired pneumonia.
2. To learn about pulmonary infections in immunocompromised hosts.
3. To become familiar with CT signs suggesting fungal infection.

### **B. Tuberculosis (TB)**

Igor E. Tyurin; Moscow/RU

1. To evaluate the imaging patterns of thoracic tuberculosis.
2. To review the different imaging features of the disease in immune compromised patients.
3. To discuss the current role of imaging in nontuberculous mycobacterial disease.

### **C. Infectious endocarditis**

Hatem Alkadhi; Zurich/CH

1. To review the valvular consequences of untreated infections.
2. To become familiar with the CT signs of endocarditis in native valves.
3. To learn about the typical appearance of infectious complications after valvular surgery.



## **E<sup>3</sup> 1519 - Mediastinal and cardiac tumours in adults**

### **A. Prevascular compartment of the mediastinum**

José Vilar; Valencia/ES

1. To become familiar with the main causes of prevascular tumours.
2. To review the CT features of thymic malignancies.
3. To learn when to suspect lymphoma and when to suggest percutaneous biopsy.

### **B. Paravertebral space**

Mariaelena Occhipinti; Florence/IT

1. To become familiar with the posterior mediastinal pathology.
2. To review the typical and atypical features of neurogenic tumours.
3. To learn about less frequent causes of paravertebral space masses.

### **C. Cardiac masses: a survival guide**

Valentin E. Sinitsyn; Moscow/RU

1. To learn how to differentiate thrombi from tumours of the cardiac cavities.
2. To review the main differential diagnosis of cardiac tumours.
3. To learn about the role of US, CT, and MRI for diagnosis and characterisation.

## **E<sup>3</sup> 1619 - Pulmonary embolism/pulmonary hypertension**

### **A. Diagnosis of acute pulmonary embolism (PE)**

Marie-Pierre Revel; Paris/FR

1. To review the role of clinical probability scores and D-dimer assessment.
2. To learn about tips and tricks to optimise arterial opacification on CT.
3. To learn about key features to report in acute PE.

### **B. Pulmonary hypertension**

Anagha P. Parkar; Bergen/NO

1. To become familiar with the causes of pulmonary hypertension.
2. To learn about the radiological presentation of pulmonary artery hypertension.
3. To understand how imaging helps patient management.

### **C. The heart in pulmonary hypertension**

Karl-Friedrich Kreitner; Mainz/DE

1. To learn about cardiac causes of pulmonary hypertension.
2. To become familiar with cardiac assessment in pulmonary hypertension.
3. To recognise the prognostic importance of right ventricle dysfunction in pulmonary hypertension.



E<sup>3</sup> - Advanced Courses: Interactive Teaching Sessions for Young (and not so Young) Radiologists

## **E<sup>3</sup> 121 - Musculoskeletal tumours**

### **A. Soft tissue tumours**

Filip M.H.M. Vanhoenacker; Antwerp/BE

1. To describe the imaging findings of soft tissue tumours.
2. To review the differential diagnosis of soft tissue tumours and tumour-like conditions.

### **B. Bone tumours**

F. Bilge Ergen; Ankara/TR

1. To describe imaging findings of musculoskeletal tumours and tumour-like conditions.
2. To recognise imaging pitfalls of musculoskeletal tumours and tumour-like conditions.

## **E<sup>3</sup> 221 - Emergency and chest radiology**

### **A. Dyspnoea in oncologic patients: how to approach it**

Cornelia M. Schaefer-Prokop; Amersfoort/NL

1. To learn about the role of imaging in oncologic patients with dyspnoea.
2. To understand the importance of clinical data for narrowing the differential diagnosis

### **B. Blunt thoracic trauma: from the plain film to CT**

Anastasia Oikonomou; Toronto, ON/CA

1. To learn about the spectrum of radiological findings in blunt thoracic trauma.
2. To emphasise the importance of CT reformations for the detection of severe complex traumatic injuries.

## **E<sup>3</sup> 321 - Imaging of the liver**

### **A. CT and MRI liver imaging reporting and data system (LI-RADS): how to use it and what to expect**

Anna Darnell; Barcelona/ES

1. To become familiar with LI-RADS categories, definitions and algorithms.
2. To discuss the confusing features of LI-RADS with examples.
3. To understand what the probability of hepatocellular carcinoma is for each LI-RADS category.

### **B. Focal lesions in non-cirrhotic liver: how to diagnose, differentiate and manage**

Giuseppe Brancatelli; Palermo/IT

1. To learn how to differentiate focal liver lesions in non-cirrhotic patients with CT and MRI.
2. To know how to manage non-cirrhotic patients with focal liver lesions.



## **E<sup>3</sup> 421 - Small bowel imaging**

### **A. CT and MR enterography: my technical tips for preparation and scanning**

António J.B.S. Madureira; Porto/PT

1. To understand the importance of proper preparation for enterography.
2. To be familiar with technical details that ensures high imaging quality.

### **B. Detection of small bowel involvement in patients with peritoneal carcinomatosis before hyperthermic intraperitoneal chemotherapy (HIPEC)?**

Michael R. Torkzad; Stockholm/SE

1. To understand how to optimise imaging techniques to detect peritoneal involvement of the small bowel.
2. To be familiar the various imaging characteristics of peritoneal involvement of the small bowel.

## **E<sup>3</sup> 521 - Musculoskeletal radiology: arthropathies**

### **A. Extremities**

Ustun Aydingoz; Ankara/TR

1. To explain the key points in the differential diagnosis of common arthropathies in the extremities.
2. To describe the imaging findings of common arthropathies in the extremities as they relate to pathophysiology.

### **B. The axial skeleton**

Apostolos H. Karantanas; Iraklion/GR

1. To explain the key points in the differential diagnosis of arthropathies in the axial skeleton.
2. To describe the imaging findings of arthropathies in the axial skeleton as they relate to pathophysiology.

## **E<sup>3</sup> 621 - Neuroradiology: paediatric and adult**

### **A. Imaging in epilepsy: how to scan and find the suspect**

Michael Okujava; Tbilisi/GE

1. To describe best imaging protocols when considering the patient's age.
2. To review common epileptogenic lesions and their imaging features.
3. To define contributions from advanced imaging.

### **B. Imaging in movement disorders: keeping up with the neurologist**

Kader Karli Oguz; Ankara/TR

1. To review common movement disorders and basic mechanisms.
2. To define the role of radiologic examinations and review ideal imaging protocols.
3. To review diagnostic radiologic patterns in classified movement disorders.



## **E<sup>3</sup> 721 - Cardiac imaging: an update**

### **A. Coronary artery disease - reporting and data system (CAD-RADS): a new tool for reporting coronary CT angiograms (CTAs)**

Bálint Szilveszter; Budapest/HU

1. To be familiar with standardised reporting of coronary CTA findings.
2. To know the impact of CAD-RADS in management and treatment.

### **B. Athlete's heart**

Jan Bogaert; Leuven/BE

1. To learn about the different entities that cause left ventricular thickening.
2. To understand the role of the different techniques in the study of this patients.

## **E<sup>3</sup> 821 - Gynecological cancer imaging**

### **A. Cervical cancer**

Teresa Margarida Cunha; Lisbon/PT

1. To describe the imaging findings of cervical cancer.
2. To learn about the new International Federation of Gynecology and Obstetrics (FIGO) classification and its implications.
3. To define the role of radiologic examinations and review ideal imaging protocols.
4. To recognise imaging pitfalls in cervical cancer.

### **B. Ovarian cancer: new challenges**

Stephanie Nougaret; Montpellier/FR

1. To be familiar with the histological subtype of the epithelial ovarian cancer.
2. To become familiar with the revised FIGO staging system.
3. To learn about the role of imaging in recognising "difficult to resect" disease.

## **E<sup>3</sup> 921 - Imaging of the face**

### **A. Facial infections and complications**

Martin G. Mack; Munich/DE

1. To become familiar with the key concepts and imaging features of facial infections.
2. To learn how to integrate clinical findings with radiological features.

### **B. Facial pain**

Damien-Arthur Varoquaux; Marseille/FR

1. To become familiar with the key concepts and imaging features of facial pain.
2. To learn how to integrate clinical findings with radiological features.

## **E<sup>3</sup> 1021 - Focal testicular lesions: challenging conditions**

### **A. Acutely painful lesions**

Vikram S. Dogra; Rochester, NY/US

1. To describe the imaging findings of tumours and tumour-like testicular lesions presenting clinically with acute scrotal pain.
2. To learn how to integrate clinical and imaging findings for the differential diagnosis between benign and malignant lesions.

### **B. The small, incidentally detected lesion**

Paul S. Sidhu; London/UK

1. To learn about the prevalence of small testicular lesions incidentally detected at US.
2. To learn how to improve characterisation of small incidentally detected testicular lesions.
3. To discuss how to manage the patient with small incidentally detected testicular lesions.

## **E<sup>3</sup> 1121 - Imaging of head and neck manifestations of systemic disease**

### **A. Autoimmune disorders: IgG, Sjogren's syndrome and others**

Minerva Becker; Geneva/CH

1. To become familiar with the imaging characteristics of autoimmune disease manifestations in the head and neck.
2. To learn how to avoid interpretation pitfalls on CT, US and MRI.

### **B. Lymphatic and haematopoietic neoplasms**

Frank Pameijer; Utrecht/NL

1. To become familiar with the imaging characteristics of lymphatic and haematopoietic neoplasms affecting the head and neck.
2. To learn how to avoid interpretation pitfalls on CT, US and MRI.

## **E<sup>3</sup> 1221 - Breast lesions of uncertain malignant potential (B3 lesions): the management conundrum**

### **A. Imaging appearance of B3 lesions**

Pascal A.T. Baltzer; Vienna/AT

1. To understand the entire spectrum of the lesions with uncertain malignant potential (B3).
2. To learn how B3 lesions appear on mammography, tomosynthesis, contrast-enhanced mammography, ultrasound, non-contrast and contrast-enhanced MRI.
3. To discuss their different biological behaviour in relation to contrast-enhanced imaging modalities.

### **B. The clinical management of B3 lesions**

Simone Schiaffino; Milan/IT

1. To distinguish between low and high-risk B3 lesions.
2. To know the impact of needle size and imaging guidance on exclusion of associated malignancy.
3. To learn how to discuss the clinical management of B3 lesions in the multidisciplinary meeting.

## **E<sup>3</sup> 1321 - Imaging of the retroperitoneum**

### **A. Retroperitoneal lesions**

Subramaniyan Ramanathan; Doha/QA

1. To illustrate the spectrum of primary retroperitoneal tumours and non-neoplastic disease.
2. To explain the key points in the differential diagnosis.
3. To learn how to avoid interpretation pitfalls.

### **B. Subperitoneal, perirectal and deep pelvic lesions**

Mustafa Secil; Izmir/TR

1. To illustrate the spectrum of benign and malignant perirectal and deep pelvic lesions.
2. To discuss the imaging features of these lesions.
3. To understand how to narrow the differential diagnosis.

## **E<sup>3</sup> 1421 - Cross-sectional imaging of bone metastases**

### **A. Is it a bone metastasis (incidental lesions)?**

Sabine Weckbach; Heidelberg/DE

1. To illustrate the imaging appearance of bone metastases.
2. To review the imaging protocols for evaluation of bone metastases.
3. To illustrate how to differentiate between metastases and other focal bone lesions.
4. To illustrate the pitfalls and limitations of imaging in assessment of metastatic bone disease.

### **B. Dedicated whole-body staging for bone metastases**

Giuseppe Petralia; Milan/IT

1. To review current image acquisition and interpretation for whole-body MRI.
2. To illustrate the clinical applications for whole-body MRI in assessment of metastatic bone disease.
3. To illustrate the potential and limitations of whole-body MRI in assessment of metastatic bone disease.

## **E<sup>3</sup> 1521 - Pelvic pain in female patients**

### **A. Acute pain**

Milagros Otero García; Vigo/ES

1. To become familiar with different uterine and adnexal pathologies presenting acute pelvic pain.
2. To learn about integrating clinical findings with imaging features before establishing a diagnosis.

### **B. Chronic pain**

Marcia C. Javitt; Haifa/IL

1. To become familiar with different uterine and adnexal pathologies presenting chronic pelvic pain.
2. To learn about integrating clinical findings with imaging features before establishing a diagnosis.

E<sup>3</sup> - Advanced Courses: Neuro

## **E<sup>3</sup> 118 - Metabolic disorders: common and complex**

### **A. Posterior reversible encephalopathy syndrome (PRES): still no name change?**

Sven Haller; Geneva/CH

1. To discuss the pathophysiology and new insights of PRES.
2. To give an overview of imaging findings in PRES.
3. To learn how to recognise PRES differentials.

### **B. Acquired metabolic diseases**

Jasmina Boban; Novi Sad/RS

1. To learn about the most important acquired metabolic diseases affecting the brain.
2. To understand the underlying pathology of intoxications.
3. To become familiar with drugs-related neurotoxicity.

### **C. Prognostication of hypoxic-ischaemic injury (HII)**

Zoran Rumboldt; Rovinj-Rovigno/HR

1. To explain imaging findings in HII.
2. To learn how to evaluate the prognosis.
3. To discuss the diagnosis of brain death.

## **E<sup>3</sup> 218 - Inflammation: the burning brain**

### **A. Vessel wall imaging: how to do it**

Jeroen Hendrikse; Utrecht/NL

1. To understand vessel wall imaging.
2. To learn when and how to use vessel wall imaging.
3. To learn about the possible pitfalls in using vessel wall imaging.

### **B. Vasculitis: what can we see with new MRI techniques?**

Hans Rolf Jäger; London/UK

1. To discuss the imaging findings in CNS vasculitis.
2. To understand the value of each MRI technique in the evaluation of vasculitis.
3. To discuss the pathological findings and their clinical relevance.

### **C. Autoimmune diseases: new pandemia?**

Philippe Demaerel; Leuven/BE

1. To learn about the rising incidence of autoimmune mediated diseases.
2. To discuss the imaging findings suggestive of autoimmune encephalitis.
3. To understand the clinical scenarios and indications for imaging.



## **E<sup>3</sup> 318 - Brain tumours: new classification, new names, new challenges**

### **A. Glioblastoma: what is really important?**

Sotirios Bisdas; London/UK

1. To become familiar with the current classifications of glioblastoma.
2. To learn how to distinguish between glioblastoma and lymphoma.
3. To understand the value of advanced techniques in evaluating.

### **B. Child with posterior fossa tumour: what next?**

Mariasavina Severino; Genoa/IT

1. To learn about the most common posterior fossa tumours in children.
2. To understand the challenges in the interpretation of images.
3. To appreciate the new classifications and genetic insights.

### **C. Tumour or therapy-induced changes**

Pia C. Maly Sundgren; Lund/SE

1. To learn about therapy-induced phenomena.
2. To appreciate diagnostic strategy in the differentiation between recurrence and therapy-induced changes.
3. To understand how to use advanced techniques in treatment monitoring.

## **E<sup>3</sup> 418 - Vascular disorders beyond stroke: small arteries and veins**

### **A. Cerebral amyloid angiopathy (CAA) and other small vessel diseases**

Fabrice Bonneville; Toulouse/FR

1. To learn about imaging findings in CAA.
2. To discuss vascular dementia.
3. To review imaging findings in small vessel disease.

### **B. Not every black dot on susceptibility weighted imaging (SWI) is a microbleed**

Paul M. Parizel; Perth, WA/AU

1. To review differential diagnosis of multiple black dots on SWI.
2. To understand how to use SWI in neurological diseases.
3. To appreciate the value of SWI in routine brain protocols.

### **C. Veins are different**

Pedro Vilela; Almada/PT

1. To learn about venous diseases.
2. To review the imaging findings in venous sinus thrombosis.
3. To become familiar with venous infarcts.



## **E<sup>3</sup> 518 - Seizures: disrupted connections**

### **A. Imaging in seizures: how to identify the epileptogenic focus**

Christopher Hess; San Francisco, CA/US

1. To discuss the "perfect" protocol in patients with seizures.
2. To learn about the structural MRI in seizures.
3. To discuss the value of functional MRI.

### **B. Temporal lobe epilepsy (TLE)**

Núria Bargalló; Barcelona/ES

1. To learn the anatomy of the temporal lobe necessary for the evaluation of TLE.
2. To adopt the "temporal lobe epilepsy protocol".
3. To review the underlying causes of temporal lobe epilepsy.

### **C. Status epilepticus**

Paolo Vitali; Pavia/IT

1. To learn about the definition and clinical presentation of status epilepticus.
2. To understand CT and MRI findings in status epilepticus.
3. To discuss postictal imaging findings.



EFOMP Workshop: New European Quality Controls for State-of-the-Art Innovations in Radiology and Artificial intelligence: The Role of the Medical Physicist

## **EF 2 - European quality controls (QC) in innovation, safety, and artificial intelligence (AI)**

### **Artificial intelligence and medical physics data validation: system modelling**

Federica Zanca; Leuven/BE

1. To learn about the robustness of AI systems and why QC procedures are necessary.
2. To understand the concepts of approving AI systems, its challenges and limitations, and its relevance to diagnostic accuracy and safety.
3. To become familiar with how the new guidance can be implemented and used in a practical manner.

### **A universal model for breast dosimetry**

Ioannis Sechopoulos; Nijmegen/NL

1. To learn why a Europe wide consistent approach is necessary for medical physicists involved in clinical trials and where they fit in the multidisciplinary team.
2. To understand the rationale and challenges for the new guidances and its relevance to diagnostic accuracy and safety.
3. To become familiar with how the new guidances can be implemented in a practical manner.

### **The role of medical physics experts in clinical trials**

Natalie Abbot; Cardiff/UK

1. To learn why a Europe wide consistent approach is necessary for medical physicists involved in clinical trials and where they fit in the multidisciplinary team.
2. To understand the rationale and challenges for the new guidance and its relevance to diagnostic accuracy and safety.
3. To become familiar with how the new guidances can be implemented in a practical manner.



EuroSafe Imaging Sessions

## **EU 1 - Ethics and radiation protection of the patient: a focus on medical imaging**

*Jointly organised by the ESR and WHO*

### **Ethics in the context of EuroSafe Imaging**

Guy Frija; Paris/FR

1. To learn the evolving position of ethics in radiation protection in medicine.
2. To identify ethical challenges for the implementation of the radiation protection system in medical imaging.
3. To appreciate the EuroSafe response to these developments.

### **Ethics in radiation protection of patients: ICRP activities**

Francois Bochud; Lausanne/CH

1. To learn about the existence of ICRP-138, a report setting out the ethics foundation of radiation protection.
2. To appreciate why ICRP is developing a new report on ethics of radiation protection in medical diagnosis/treatment.
3. To understand the concepts and values that will be introduced in the new ICRP report.

### **Ethics in radiological practice**

Dina Husseiny Salama; Cairo/EG

1. To learn about the importance of ethics for radiology in day-to-day practice.
2. To become familiar with ethical dilemmas that may arise when implementing the system of radiation protection in radiology.
3. To understand the importance of information for, and personal contact with, patients in day-to-day practice.



## **EU 3 - Essential requirements for dose management systems (DMS): what do we really need?**

### **Dosimetric parameters of x-ray modalities as an input source for DMS**

Eliseo Vaño; Madrid/ES

1. To learn about the option of dosimetric quantities to be used for the different imaging modalities.
2. To appreciate the advantages to auditing the typical patient dose values compared to DRLs.
3. To understand the need to periodically validate the dosimetric values transferred to the DMS.

### **Experience and problems with the implementation of DMS in clinical routine**

Virginia Tsapaki; Athens/GR

1. To learn about the practical steps to follow to facilitate the process of procurement to installation.
2. To appreciate the importance of various DMS technical characteristics and how they can affect the clinical practice.
3. To understand the challenges related to the practical implementation of DMS into the daily clinical practice.

### **Requirements and workflow of DMS in the clinical context of HIS, RIS, and PACS**

Peter Mildenerger; Mainz/DE

1. To learn about the requirements for standardised dose reporting.
2. To appreciate the integration profiles for interoperability between different vendors.
3. To understand the value of the integration of DMS into clinical information systems.

### **Networking of individual dose management systems to create a centralised dose repository for benchmarking and national dose collection**

Sebastian T. Schindera; Aarau/CH

1. To learn about the main objectives of a centralised dose repository.
2. To appreciate the requirements of establishing a centralised dose repository.
3. To understand the main challenges of a centralised dose repository.

## **EU 4 - A historical overview of CT dose exposure: past, present, and future**

### **From past to present: how have advances in CT technology impacted radiation doses?**

Mahadevappa Mahesh; Baltimore, MD/US

1. To understand how CT dose-reduction technology evolves.
2. To become familiar with modern CT dose-reduction technology.
3. To learn how advances in CT technology have impacted radiation doses.

### **Year 2021: what still needs to be done to reduce doses for CT?**

Virginia Tsapaki; Athens/GR

1. To propose new strategies that should be implemented for CT dose reduction.
2. To become familiar with the tools available for CT dose management.
3. To learn what still needs to be done to reduce doses for CT.

### **The road ahead: how can we overcome hurdles towards reliable clinical CT dosimetry?**

John Damilakis; Iraklion/GR

1. To appreciate the value of personalised dosimetry in CT.
2. To understand how artificial intelligence can support the CT dose-reduction process.
3. To learn how to overcome obstacles towards reliable clinical CT dosimetry.



## **EU 7 - Medical radiation exposure of patients**

*Jointly organised by EuroSafe Imaging and ECR Subcommittee on Physics in Medical Imaging*

### **Medical radiation exposure of patients in the United States: methodology, data sources, and results**

Mahadevappa Mahesh; Baltimore, MD/US

1. To learn how different data sources can be used to estimate the number of imaging procedures.
2. To appreciate the difficulties in estimating radiation doses per imaging procedure.
3. To understand the method to estimate medical radiation exposure per person.

### **Medical radiation exposure of the paediatric population**

Donald P. Frush; Durham, NC/US

1. To become familiar with the various imaging procedures performed in the paediatric population.
2. To appreciate how size matters and that imaging protocols are key to dose optimisation.
3. To understand the status of paediatric imaging in the United States as per NCRP 184.

### **UNSCEAR's global report on radiation exposure of patients**

Peter Thomas; Yallambie, VIC/AU

1. To learn about the survey results of the global radiation exposure of patients.
2. To appreciate the challenges in coordinating data regarding the number of imaging procedures from various countries.
3. To understand how the model can be utilised to estimate radiation exposure.

