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Appendix
Appendix 1 – Clinical Radiology Condition Listings
INTRODUCTION

The clinical radiology learning outcomes reflect the key competencies expected from RANZCR trainees at the end of their training journey. The learning outcomes are developed to support the learning and development of clinical radiologists and prepare them for future changes. The expectation is that at the end of training, clinical radiology trainees are capable of safe, independent practice in delivering quality patient care.
Section One
INTRINSIC ROLES
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_INTRINSIC ROLES_

1.1 COMMUNICATOR

Establishing rapport with patients
1.1.1 Establish rapport with patients, engendering trust.
1.1.2 Communicate using a patient-centred approach, demonstrating empathy and compassion. Assist patients in managing anxiety, providing reassurance.
1.1.3 Demonstrate effective active listening skills, including asking open questions, using non-verbal communication to show engagement.
1.1.4 Use non-verbal communication effectively, such as when a patient is unable to speak during an examination or procedure.
1.1.5 Describe potential barriers to effective cross-cultural communication and utilise strategies to overcome them.
1.1.6 Recognise the need to use an interpreter, indigenous health worker or cultural support staff to facilitate communication with patients from culturally and linguistically diverse backgrounds, particularly in relation to obtaining informed consent.

Communication with patients
1.1.7 Obtain accurate and relevant information from patients to confirm information received from the referrer.
1.1.8 Elicit additional details when there appears to be a discrepancy with the request. Explain procedures to patients in a manner which facilitates understanding.
1.1.9 Recognise the impact of language, literacy and cultural considerations on the patient’s participation in their care.
1.1.10 Be familiar with and utilise resources as appropriate to help patients and their families make informed decisions regarding their care.
1.1.11 Obtain valid informed consent by checking mutual understanding and encouraging questions to clarify any concerns.
1.1.12 Disclose adverse incidents or events to patients appropriately, according to local jurisdictional guidelines.
1.1.13 Manage challenging communication issues such as delivering bad news, confusion and misunderstanding.

Communication with colleagues
1.1.14 Adjust communication to suit the level of understanding of other medical specialists and health professionals.
1.1.15 Convey expert opinion, degree of certainty in the diagnosis, and its implications effectively.
1.1.16 Share patient information in a manner which respects privacy and confidentiality, de-identifying images for education purposes and obtaining consent for use when required.
1.2 COLLABORATOR

Working with others
1.2.1 Develop a good working relationship with others, including members of the immediate and wider clinical team.
1.2.2 Respect and understand the role and expertise of the team including medical imaging technicians (MIT), allied health professionals and nurses.
1.2.3 Provide assistance and advice to referring doctors with regard to the most effective investigative pathway for a patient.
1.2.4 Set realistic expectations with regard to service delivery. Effectively liaise with other staff to prioritise and schedule patients.
1.2.5 Demonstrate respect for different opinions and approaches, negotiating and challenging when appropriate.
1.2.6 Seek advice from clinical colleagues where their expertise may contribute to a better outcome.
1.2.7 Take responsibility for assigned tasks and support others to achieve shared goals.

Contribution to multidisciplinary team meetings
1.2.8 Negotiate access to imaging studies performed external to the hospital or practice.
1.2.9 Collate and integrate imaging as required to facilitate decision making about patient management plans.
1.2.10 Facilitate the discussion of investigative options in a multidisciplinary team setting.
1.2.11 Participate in and coordinate multidisciplinary meetings, advising on the role that current and future imaging plays in the patient’s journey and management.
1.2.12 Present independently at clinical meetings, including multidisciplinary team meetings.
1.2.13 Work collaboratively with other members of the multidisciplinary health care team.

Conflict management and resolution
1.2.14 Demonstrate respect toward colleagues.
1.2.15 Recognise signs of potential conflict and clinical situations that may lead to conflict.
1.2.16 Implement strategies to manage differences of opinion and prevent and/or resolve conflicts.
1.2.17 Negotiate an acceptable outcome of conflict for all parties, either individually or by leading others.

Handover
1.2.18 Determine when care should be transferred to another radiologist or health professional.
1.2.19 Demonstrate safe handover of care, using both verbal and written communication, post-radiological procedure or transfer to another health care team.
1.3 LEADER

Improvement of clinical radiology service delivery
1.3.1 Describe key indicators for monitoring service quality and performance in clinical radiology.
1.3.2 Identify where quality improvements might be initiated in the work environment.
1.3.3 Recognise the importance of and contribute to quality assurance and improvement activities in a department or practice.
1.3.4 Be familiar with incident reporting and monitoring systems, including the investigation of an adverse event, ‘near-miss’ or system error.
1.3.5 Participate in the development and implementation of patient safety initiatives.

Healthcare resources
1.3.6 Discuss funding arrangements for clinical radiology service delivery in Australia and New Zealand.
1.3.7 Recommend investigations for individual patients responsibly, with consideration of controlling costs of healthcare.
1.3.8 Allocate resources responsibly, considering and balancing the benefits to the patient and the hospital.
1.3.9 Promote the use of the Choosing Wisely recommendations and clinical decision rules to encourage clinicians to perform fewer scans to decrease potential harm to patients and target healthcare resources more effectively.

Leadership skills
1.3.10 Demonstrate leadership skills within the radiological team and department or practice.
1.3.11 Delegate clinical activities safely to colleagues and other members of the health care team.
1.3.12 Run effective and efficient meetings.
1.3.13 Discuss the key steps in managing change and initiate effective communication with regard to the implementation of new policies or processes.

Managing career and a practice
1.3.14 Set priorities and manage time to integrate practice and personal life.
1.3.15 Demonstrate strategies and techniques to manage the negative effects of stress and maintain personal health and wellness.
1.3.16 Be aware of the process and costs involved in establishing a new clinical radiology department or practice, including staffing, equipment and facility components.

1.4 HEALTH ADVOCATE

Individual patients
1.4.1 Recognise, and help overcome, barriers to quality patient care.
1.4.2 Advocate for patients in multidisciplinary meetings, ensuring management plans are patient-focused.
1.4.3 Advocate for investigations that minimise risk, radiation exposure and cost to the patient. Adhere to safety protocols to minimise risk and protect patients.
1.4.4 Apply jurisdictional privacy policies which govern the use of personal information within the service and disclosure to other parties.
1.4.5 Identify suspected neglect or abuse and report accordingly.

In the community
1.4.6 Advocate for additional services for communities in need.
1.4.7 Advocate for resources for radiological services which are evidence based, i.e. government subsidisation of current and emerging technologies.
1.4.8 Provide accurate information to the community and consumer groups with regard to issues relevant to clinical radiology.
1.5 PROFESSIONAL

Individual patients
1.5.1 Exhibit appropriate professional behaviours and relationships in all aspects of practice, demonstrating honesty, integrity, commitment, altruism and respect for diversity.
1.5.2 Recognise and respond appropriately to ethical issues encountered in practice. Adhere to radiological practice standards.
1.5.3 Prioritise urgent studies and take responsibility for communicating unexpected results to clinical team members.
1.5.4 Behave in a manner that is inclusive of social, ethnic and religious groups.
1.5.5 Acknowledge professional limitations and seek advice or help when required. Exhibit professional behaviours in technology-enabled communication.

Commitment to the profession
1.5.6 Fulfil and adhere to professional and ethical codes, standards of practice and regulations including but not limited to:
   - Informed consent
   - Mandatory reporting
   - Occupational health and safety
   - Privacy and confidentiality
   - Credentialing.
1.5.7 Provide support to the profession through participation in scientific meetings and other educational events.
1.5.8 Maintain medical registration and relevant insurances. Speak respectfully of other clinicians and professionals.
1.5.9 Recognise and manage conflicts of interest.
1.5.10 Recognise the legal aspects of practice and the potential for radiologists to be defendants or consultants in litigation.

1.6 SCHOLAR

Lifelong learning
1.6.1 Identify opportunities to improve knowledge and skills, through reflection and evaluation of performance.
1.6.2 Seek feedback from patients, colleagues and other health professionals in relation to potential areas of improvement.
1.6.3 Actively participate in continuing professional development to address learning needs. Participate in audit of clinical results, including audit of personal practice.
1.6.4 Demonstrate knowledge of principles of the peer-review process and participate in peer review.

Evidence-based medicine
1.6.5 Discuss the concept of evidence-based best practice.
1.6.6 Employ a systematic process to keep up to date with current literature.
1.6.7 Define and describe levels of evidence and the principles of defining levels of evidence (e.g. NHMRC).
1.6.8 Critically appraise research papers and other research-related documents.
1.6.9 Assess the validity of a study, taking into consideration potential confounders and biases, and applicability to the local context.
1.6.10 Discuss relevant literature with patients, colleagues and other health professionals relevant to their clinical practice.
1.6.11 Revise and/or amend department protocols and imaging pathways as required, as new evidence emerges.
1.6.12 Integrate published evidence into daily radiological practice to improve patient care.
Research

1.6.13 Discuss the key principles, advantages and disadvantages of common clinical trial designs (e.g. randomised controlled trials, case-control studies, historical and concurrent controls, blind and double-blind studies).

1.6.14 Compare and contrast the aims of qualitative and quantitative research.

1.6.15 Explain common research terminology (e.g. hypotheses, endpoints, outcomes, incidence, prevalence, biases, intention-to-treat, number needed to treat).

1.6.16 Explain and utilise the concepts of sensitivity, specificity, positive predictive value and receiver operator curve in the evaluation and performance of radiological research.

1.6.17 Discuss common statistical methods and tests and their application. Discuss levels of significance, types of errors and power calculations.

1.6.18 Describe and select appropriate outcome measures (e.g. overall survival, disease-free survival, time to progression, quality of life).

1.6.19 Demonstrate knowledge of other types of research relevant to clinical radiology (e.g. laboratory, health economics and education research).

1.6.20 Identify areas of radiological practice where research is warranted, determine appropriate radiological research questions, and develop research methodology appropriate to questions.

1.6.21 Develop a sound research proposal, including a clear research question/s methodology, and ethics requirements.

1.6.22 Contribute to clinical research that advances radiological practice and patient care.

1.6.23 Describe and apply the principles of privacy, confidentiality, informed consent and disclosure of information relative to performance of research projects.

1.6.24 Comply with national standards for research ethics.

1.6.25 Respect intellectual property rights and take a strong stand against plagiarism. Disseminate research findings through publication.

1.6.26 Present research findings at scientific meetings.

Lifelong learning

1.6.27 Plan and deliver education for students, junior colleagues and other health professionals.

1.6.28 Apply novel methods and approaches to teaching.

1.6.29 Promote a safe learning environment.

1.6.30 Ensure patient safety is maintained when learners are involved. Encourage and mentor students and junior colleagues.

1.6.31 Contribute to the development of teaching/educational programs for other specialties. Provide constructive feedback to learners on their performance.
1.7 CULTURAL COMPETENCY

Cultural awareness and safety

1.7.1 Discuss the cultural determinants of health and its effect on equity, acknowledging that differences in health status are unfair and unjust and the result of differential access to the resources necessary for people to lead healthy lives.

1.7.2 Discuss how conscious and unconscious bias of health professionals may influence the care of patients.

1.7.3 Describe how the history of Aboriginal and Torres Strait Islander peoples (Australian) and Maori and Pacific peoples (New Zealand) may affect their health status, perception of medical services and interactions with health professionals.

1.7.4 Discuss varying perceptions of health and illness across different cultures and apply this knowledge to individual patient care.

1.7.5 Apply knowledge of a patient’s cultural, social and religious background, and individual beliefs in developing, communicating and carrying out management plans.

1.7.6 Recognise the family and community context of patients from different cultural backgrounds and its impact on consent, treatment and follow-up.

1.7.7 Partner with cultural support staff, including aboriginal liaison officers, to promote cultural safety and tailor care for patients from all cultural backgrounds.

1.7.8 Demonstrate a commitment to:
   - Understanding personal cultural values and the influence these have on your interactions with patients and colleagues
   - Ongoing development of personal cultural awareness and practices
   - Challenge the cultural bias of individual colleagues or systemic bias within health care services where this will have a negative impact on patients.
Section Two
APPLIED IMAGING TECHNOLOGY
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APPLIED IMAGING TECHNOLOGY

Overview
The trainee will be able to:
• Describe the physical principles associated with image acquisition, quality and display
• Explain the regulatory requirements regarding imaging systems, quality assurance programs and radiation safety
• Discuss the safety implications regarding radiation exposure and how to optimise patient radiation dose and image quality.
2.1 THEORETICAL PRINCIPLES

*By the completion of training, the trainee will be able to:*

**Basic Concepts of Electromagnetic Radiation (BCER)**

2.1.1 Describe:
- Electromagnetic waves
- Relationship between frequency and wavelength
- The electromagnetic spectrum
- Sources of electromagnetic radiation
- Energy of photons.

2.1.2 Outline the principle of wave-particle duality of photons.

**Production of X-Rays**

2.1.3 Describe the production of X-rays and the distinction between Bremsstrahlung and Characteristic radiation.

2.1.4 Describe and illustrate the spectrum of X-ray energies produced by an X-ray tube.

2.1.5 Discuss the impact of changes in peak kilovoltage (kVp), anode material, milliampere (mA) and filtration on the X-ray spectrum, patient dose and image quality.

2.1.6 Describe and illustrate the basic components of X-ray tube construction.

2.1.7 Describe and illustrate the line focus principle.

2.1.8 Broadly describe and illustrate the heel effect and its implication for image quality.

**Interactions between X-Rays and matter of relevance to medical imaging**

2.1.9 Distinguish between atomic ionisation and excitation in respect of:
- Photostimulable phosphors
- Luminescence
- Thermoluminescent Dosimeters (TLDs).

2.1.10 Describe the interaction processes of photoelectric effect and Compton scattering.

2.1.11 Discuss the impact of field size, kVp and patient thickness on scatter production.

2.1.12 Describe the coherent scattering interaction process.

2.1.13 Describe the process of attenuation.

2.1.14 Describe the attenuation of monoenergetic and polychromatic radiation in terms of linear and mass attenuation coefficients and half-value layers (HVLs).

2.1.15 Outline the factors that impact on attenuation.

**Filters, collimators and grids**

2.1.16 Explain what is meant by inherent and added filtration.

2.1.17 Describe the impact of filtration on the spectrum from an X-ray tube, including filter material (e.g. Al, Cu, K-edge and combination filters).

2.1.18 Describe how and why the following scatter reduction techniques work:
- Collimation
- Compression
- Grids (types, properties, implication for patient doses and image quality)
- Air gaps.

2.1.19 Discuss the implication of these techniques on image quality and dose.
Digital imaging concepts

2.1.20 Define what is meant by the following terms, and describe their application in image interpretation:

a) Image presentation
   • Pixels and voxels
   • Image matrix
   • Windowing
   • Grey scale display levels
   • Multi-planar and curved reformatting
   • Maximum/minimum intensity projections (MIP and MinIP)
   • Volume rendering
   • Subtraction imaging
   • Post processing (e.g. edge enhancement).

b) Image display
   • Monitor resolution
   • Ambient viewing conditions.

2.1.21 Distinguish between lossless and lossy images.

2.1.22 Describe the main elements of picture archiving and communications systems (PACS) and teleradiology.

2.1.23 Broadly discuss the general structure of a digital imaging and communication in medicine (DICOM) file.

2.1.24 Be aware of advanced imaging processing (e.g. perfusion, computer aided detection (CAD)).
2.2 IMAGING TECHNOLOGY

By completion of training, the trainee will be able to:

Radiography and Fluoroscopy

Radiographic image acquisition
2.2.1 Describe the key elements of the Computed Radiography (CR) system that lead to image formation, including:
   • Image processing
   • Image quality.
2.2.2 Describe the key elements of the digital radiography (DR) system that lead to image formation.
2.2.3 Differentiate between indirect (a-Si) and direct (a-Se) flat panel detector (DR) systems. Describe detector elements of DR systems.
2.2.4 Describe how an automatic exposure control (AEC) system operates in generic terms.
2.2.5 Generally describe the key factors that contribute to image quality for both film and softcopy reporting.
2.2.6 Broadly describe the concept of dual energy X-ray absorptiometry (DEXA).

Fluoroscopic image acquisition
2.2.7 Describe the modes of fluoroscopic operation and compare them with high-resolution imaging acquisition, with regard to image quality and dose.
2.2.8 Compare and contrast flat panel detectors and image intensifiers.
2.2.9 Explain the implications of field size and pulsed fluoroscopy on image quality and patient dose.
2.2.10 Describe the purpose of automatic brightness control (ABC) and broadly describe how it operates.
2.2.11 Describe the physical principles of digital subtraction angiography (DSA).
2.2.12 Describe the process of mask subtraction and understand the impact that the subtraction process has on image noise.
2.2.13 Describe what is meant by image processing operations such as pixel shifting and re-masking and explain why they are important in minimising impact of motion artefact.
2.2.14 Discuss the relationship of cumulative air kerma (CAK) and kerma-area product (KAP) to patient skin dose and effective dose.
2.2.15 Discuss strategies to minimise patient and operator dose while maintaining imaging quality.
2.2.16 Compare the application, image quality and dose of Cone Beam CT with fluoroscopy equipment, with conventional CT.

Measures of radiographic and fluoroscopic image quality
2.2.17 Discuss in detail the key image descriptors, contrast, spatial resolution, temporal resolution and noise.
2.2.18 Explain the impact of magnification and focal spot size on image quality.
2.2.19 Explain the impact of noise on image quality.
2.2.20 Explain what is meant by quantum mottle (random noise), signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR).
2.2.21 Define the line-spread function (LSF) and modulation transfer function (MTF).
2.2.22 Distinguish between quantum noise and other types of noise.
2.2.23 Explain the origin of image distortion arising from geometric effects.
**Mammography**

2.2.24 Describe

a) The basic principles of mammography:
   • Contrast improvement at low kVp
   • Magnification and contact mammography technique
   • Contrast versus radiation absorbed dose
   • Compression techniques.

b) Digital mammography:
   • Computed radiography systems
   • Digital radiography systems
   • Scanning systems.

c) Stereotactic techniques.

2.2.25 Describe the construction and operational principles of X-ray mammography equipment.

2.2.26 Discuss the impact of kVp, filtration, glandular content and breast thickness on the Mean Glandular Dose.

2.2.27 Contrast various digital methods (including detectors) which have been applied to mammography.

2.2.28 Describe the tomosynthesis and stereotactic imaging process.

2.2.29 Generally describe the:
   • Performance characteristics of X-ray mammography equipment
   • Impact of system geometry on spatial resolution
   • Effect of image processing on image quality
   • Use of CAD and quality assurance in mammography.

**Ultrasound**

2.2.30 Discuss the fundamental physics of ultrasound waves and the interactions that occur as it traverses through tissues and other media including:
   • Interference, diffraction, resonance
   • Reflection, refraction
   • Attenuation absorption, scattering.

2.2.31 Describe the various types of ultrasound transducers available and select a transducer on the basis of its physical characteristics and suitability for a given application.

2.2.32 Outline the basic principles of ultrasound imaging and processing and how various technical factors affect image quality.

2.2.33 Describe how real-time systems work, and be aware of the interplay between temporal resolution, spatial resolution and depth of penetration.

2.2.34 Describe the basic physical principles underlying the use of the Doppler effect in ultrasound imaging.

2.2.35 Explain how choice of frequency affects attenuation, spatial resolution, and the maximum flow rate that can be detected.

2.2.36 Describe the operation of a simple duplex transducer.

2.2.37 Recognise common ultrasound artefacts and explain how they are formed, including:
   • Multiple reflections – reverberation
   • Attenuation
   • Shadowing
   • Enhancement
   • Refraction – sound speed errors
   • Beam width
   • Aliasing in pulsed ultrasound Doppler (duplex and colour Doppler).
2.2.38 Discuss the basic parameters which characterise a sound wave, including:

- Wave motion and types of waves
- Wave length, frequency, phase
- Intensity, pressure, amplitude
- Decibel notation – intensity and amplitude
- Velocity in liquids and biological media
- Acoustic impedance.

2.2.39 Conduct simple calculations relating to frequency, wavelength and relative intensity in decibels.

2.2.40 Demonstrate working knowledge of the relative magnitudes of sound velocity, acoustic impedance and attenuation in various biological media, and their implications for imaging.

2.2.41 Describe details of the main physical parameters which characterise transducers and their effect on the image, including:

- Beam pattern – near and far field
- Focused transducers – types and techniques
- Broad bandwidth transducers.

2.2.42 Describe the basic principles of B-mode pulse-echo imaging, including parameters such as pulse length, frequency, pulse repetition frequency and time-gain compensation (TGC) affect the image.

2.2.43 Perform simple calculations using the Doppler shift equation and understand the concepts underlying spectral analysis colour Doppler and power Doppler.

2.2.44 Broadly describe the basic principles of:

- Panoramic imaging
- Harmonic
- Compounding
- 3D imaging
- Elastography
- US contrast agents.

2.2.45 Demonstrate a general working knowledge of more complex technology involving harmonic imaging, 3D imaging and ultrasound contrast agents.

**Computed Tomography (CT)**

2.2.46 Discuss the principles of CT scanning.

2.2.47 Describe various methods of image reconstruction including:

- Filtered back projection and iterative reconstruction
- Hounsfield units
- Field of view
- Reconstruction algorithm (aka filter or kernel)
- Electrocardiographic (ECG) gating (prospective and retrospective).

2.2.48 Explain how iterative reconstruction leads to dose reduction with similar image quality. Describe and contrast the various scanner configurations used for CT scanning, including:

- Single versus multi-detector
- Axial versus helical acquisition
- Gantry rotation speeds
- Dual-source versus single source
- Dual-energy versus single energy
- AEC-mA modulation.

2.2.49 Define Hounsfield units (HU).

2.2.50 Discuss the quality of CT images in terms of spatial and contrast resolution, noise, and slice thickness, highlighting factors that affect each.
2.2.51 Distinguish between collimated slice width, acquired slice thickness and reconstructed slice thickness.

2.2.52 Discuss the impact of pixel size, imaged slice thickness, milliampere-seconds (mAs), kVp, algorithm and field view on image quality and patient dose.

2.2.53 Discuss the advantages of lower kVp techniques on intravenous contrast-enhanced images.

2.2.54 Describe the origin and appearance of common artefacts in CT images, including:
   - Partial volume
   - Motion
   - Streak
   - Beam hardening
   - Ring.

2.2.55 Discuss radiation dose features unique to CT scanning techniques.

2.2.56 Explain in generic terms how tube current modulation works and its impact on patient dose.

2.2.57 Discuss the advantages and disadvantages of prospective and retrospective ECG gating.

2.2.58 Discuss the following different CT intervention modes and their advantages and disadvantages including their impact on occupational and patient dose:
   - Step and shoot
   - Continuous fluoroscopy.

2.2.59 Discuss the importance and application of dose descriptors and common diagnostic reference levels (DRLs):
   - Computed tomography dose index (CTDI)
   - Dose length product (DLP)
   - Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) national dose reference levels for multidetector computed tomography (MDCT).

2.2.60 Describe the method of CT perfusion.

2.2.61 Optimise paediatric protocols (e.g. weight-based, over-ranging).

2.2.62 Broadly compare cone beam CT and conventional CT in terms of differences in acquisition, image quality and dose.

2.2.63 Generally describe the unique features of the X-ray tube used in CT.

**Magnetic Resonance Imaging (MRI)**

2.2.64 Describe basic Magnetic Resonance Imaging (MRI) including:
   - Magnetic susceptibility
   - Nuclear magnetic moments
   - Effect of external magnetic field
   - Nuclear progression
   - Equilibrium magnetisation
   - Significance of Radio Frequency (RF) pulse
   - Resonance and Lamor frequency
   - Free induction Delay (FID)
   - Chemical shift types.

2.2.65 Discuss the significance and the uniqueness of the Larmor frequency for a nuclear species.

2.2.66 Describe the origin of the Free Induction Decay and discuss the key factors which determine its strength.

2.2.67 Describe the origin of the T1 and T2 relaxation mechanisms.

2.2.68 Describe the behaviour of T1 and T2 as the strength of the static field is changed. Describe the effect of field inhomogeneities and T2.

2.2.69 Describe the pulse sequences including spin-echo, inversion recovery, short-T1 inversion recovery (STIR) and fat suppression.

2.2.70 Outline the advantages and characteristic features of Gradient Echo, Fast Spin Echo, Echo Planar Imaging (EPI) and other fast imaging techniques.
2.2.71 Outline the advantages and disadvantages of imaging at different commercially available field strengths (e.g. 1.5 Tesla, 3 Tesla).

2.2.72 Describe how images are produced in reference to:
   - Gradient fields
   - Slice thickness and RF bandwidth
   - Phase-encoding gradient
   - Frequency encoding (readout) gradient
   - Determinants of image acquisition time.

2.2.73 Discuss the physics behind the chemical shift phenomenon.

2.2.74 Describe interleaved multi-slice imaging and indicate why it is utilised.

2.2.75 Describe the factors that affect image quality, including:
   - Signal-to-noise ratios
   - Spatial resolution
   - Common artefacts.

2.2.76 Describe the basic types of MR angiography (MRA).

2.2.77 Describe the basic principles of diffusion weighted imaging (DWI).

2.2.78 Generally:
   - Discuss the role of the Fourier transform (FT) in MR image reconstruction
   - Describe 2D-FT reconstruction methods in terms of the three time intervals (slice selection, phase encoding and frequency encoding)
   - Compare the 3D-FT reconstruction technique with the 2D-FT method
   - Identify the biomolecular species which may be analysed in clinical MR spectroscopy (MRS).

2.2.79 In relation to MRI, broadly describe:
   a) Instrumentation
      - Magnets
      - Gradient coils
      - RF coils and electronics
      - Functional MRI.
   b) Hybrid MR-PET
   c) Intra operative MR

**Nuclear Medicine**

2.2.80 In relation to MRI, broadly describe:
   a) Instrumentation
      - Magnets
      - Gradient coils
      - RF coils and electronics
      - Functional MRI
   b) Hybrid MR-PET
   c) Intra operative MR.

2.2.81 Perform simple calculations using the concepts of physical, biological and effective half-lives.

2.2.82 Describe the main features, mode of operation and performance characteristics of a single photon emission computed tomography (SPECT) camera, gamma camera and positron emission tomography (PET) scanner.

2.2.83 Generally describe the:
   - Main features of SPECT
   - Purpose of CT in PET/CT and SPECT/CT scanners
   - Statistics and mathematics of nuclear decay.
2.3 RADIATION PROTECTION AND PATIENT SAFETY

By completion of training, the trainee will be able to:

Radiation Biology and Dosimetry

2.3.1 Define the following main radiation quantities and units used in diagnostic radiology and nuclear medicine, and the parameters they measure:
  - Exposure, Coulomb/kg
  - Air kerma, gray
  - Absorbed dose, gray
  - Equivalent dose, Sievert and radiation weighting factors
  - Effective dose, Sievert and tissue weighting factors.

2.3.2 Define basic dosimetry parameters:
  - Skin dose
  - Organ dose
  - Effective dose
  - Genetically significant dose (GSD)
  - Natural background dose.

2.3.3 Discuss the function of specific dose measurement methods used for radiological procedures and interpret the values.

2.3.4 Explain the implications of measured dose parameters, both in terms of overall risk and the risk to specific tissues and organs.

2.3.5 Be aware of the relative radiation doses from different radiological procedures, and how they compare to natural background radiation doses.

2.3.6 Examine the mechanism of how radiation interacts with tissue to cause biological damage (ionisation, excitation, free radicals), and the parameters used to quantify this damage.

2.3.7 Describe radiation carcinogenesis and other stochastic effects, including:
  - Mechanisms, spectrum of DNA damage, DNA repair
  - Latency period
  - Effect of dose and dose rate
  - Variation in organ radiation sensitivity and the effect of age
  - Risk of carcinogenesis including consideration of low doses
  - Hereditary effects
  - Chromosome damage (brief overview).

2.3.8 Outline the reasons why risk associated with low dose stochastic effects underpin international dose limits and constraints.

2.3.9 Describe the hereditary and genetic implications of radiation exposure. Assess the approximate risk from radiation exposure.

2.3.10 Discuss the variation of radiation risk for cancer induction associated with the variation of sensitivities of different cancers to radiation, variations of sensitivity with age and their associated latency periods.

2.3.11 Describe the deterministic effects of radiation and the factors which influence them:
  - Skin damage
  - Sterility
  - Cataract induction.

2.3.12 Identify the procedures that may deliver large doses of radiation.

2.3.13 Discuss the effects of radiation on the developing embryo or foetus at various stages of gestation.

2.3.14 Be aware of procedures which may deliver large doses to the embryo or foetus, and the actions to be taken in considering dose to a pregnant patient, prospectively or retrospectively.
2.3.15 Explain the importance and application of the dose descriptors:
  • Dose area products (DAPs)
  • CT dose index (CTDI)
  • Dose-length product (DLP)
  • Cumulative air kerma (CAK)
  • Mean glandular dose (MGD).

**Radiation Protection**

2.3.16 Articulate the objective of radiation protection.

2.3.17 Discuss the medical and natural sources of radiation the population is subject to in Australia.

2.3.18 Describe the differences between medical exposure (including research participants and carers) and occupational and public exposure.

2.3.19 Describe the ICRP radiological protection principles, and how they relate to categories of exposure:
  • Justification
  • Optimisation (ALARA)
  • Limitation – dose limits
  • Occupational exposure including pregnant staff
  • Public exposure.

2.3.20 State and compare the ICRP dose limits for various groups.

2.3.21 Describe, compare and contrast methods of occupational (diagnostic X-ray equipment, distance and time, protective clothing, shielding barriers) and public radiation dose reduction (restricting access to radiation areas, shielding barriers) in both diagnostic radiology and nuclear medicine environments.

2.3.22 Describe and contrast common methods of assessing occupational radiation dose including:
  • Thermoluminescent dosimeters (TLDs)
  • Optically stimulated luminescent dosimeters (OSLDs).

2.3.23 Describe the role of the radiation safety officer and the regulatory framework for radiation safety.

2.3.24 Describe what constitutes a radiation incident and compare to a radiation emergency.

**Patient Safety**

2.3.25 Describe the concept of dose audit and its relationship to DRLs and explain how DRLs are derived.

2.3.26 Describe the principle of dose optimisation, and how it is applied to diagnostic and interventional radiology.

2.3.27 Describe and contrast the most commonly used monitors for personal dose measurement.

2.3.28 Describe the various methods for calculation of patient and fetal radiation dose in radiology.

2.3.29 State approximate doses for common X-ray imaging (plain radiographic, ARPANSA CT DRLs) and common nuclear medicine examinations, ventilation/perfusion (V/Q), bone, radionuclide cardiac stress/rest scans, whole body FDG PET).

2.3.30 Describe the factors influencing patient dose in CT scanning.

2.3.31 Generally describe the methods of calculating patient and foetal radiation dose for routine diagnostic nuclear medicine studies using ICRP publications.

2.3.32 Generally describe electronic dosimeters commonly available for personal dose measurement that give immediate radiation exposure feedback and their typical applications in medical imaging.
Safety in magnetic resonance imaging
2.3.33 Discuss safety issues (patient and environmental) and contra-indications in the use of MRI, including:
- Static magnetic field
- Radiofrequency field
- Gradient field
- Pregnancy, lactation and breast feeding
- Common implants, including MRI conditional implants
- Emergencies including medical emergencies, quench and fires

Safety in ultrasound
2.3.34 Discuss the main mechanisms by which ultrasound may damage tissue.
2.3.35 Outline safe levels of exposure and safety recommendations.
2.3.36 Discuss parameters commonly used in diagnostic ultrasound to indicate risk of bioeffects:
- Thermal index
- Mechanical index.

Safety in nuclear medicine
2.3.37 Discuss radiation safety considerations for patients undergoing other imaging examinations following common nuclear medicine imaging procedures (FDG PET, bone scan, VQ scan).
2.3.38 Broadly outline
- Precautions to take when handling unsealed radioactive sources (e.g. personal protective equipment (PPE), shielding, minimisation of exposure time)
- Simple decontamination procedures for radioactive materials (liquid and solid).

Quality assurance for diagnostic imaging equipment
2.3.39 Generally describe:
- The principles and benefits of quality assurance in imaging
- The need for increased quality assurance for asymptomatic imaging processes (e.g. screening programs)
- Quality control (QC) test on radiographic, nuclear medicine, hybrid, MRI and ultrasound equipment.
Section Three
ARTIFICIAL INTELLIGENCE
SECTION THREE
ARTIFICIAL INTELLIGENCE

By the completion of training, the trainee will be able to:

• Discuss the basic concepts and principles pertaining to machine learning
• Discuss the current state (as well as the likely future trajectory) of development and deployment of machine learning within clinical medicine
• Describe the stages of machine learning model development, testing/translation, implementation and utilisation in clinical practice
• Discuss the ethics of AI relevant to medical imaging
• Discuss importance of appropriate measures to ensure safety during development, testing, deployment and post-deployment monitoring of machine learning
• Be aware of possible failure modes of machine learning systems
• Outline the potential benefits and limitations of machine learning in patient care and clinical medicine
• Describe the limitations of human perception and performance
• Discuss how those using AI may best use the combination of machine and human characteristics to provide high quality care to patients.
Section Four
ANATOMY
SECTION FOUR
ANATOMY

4.1 BRAIN

By completion of training, the trainee will be able to:

4.1.1 Identify and describe the radiological anatomy of the following structures on all relevant imaging modalities:
   • Cerebrum, including white matter tracts, grey matter nuclei, cerebral cortex and cerebral sulci and gyri
   • Functional neuroanatomy of the cortical motor and sensory systems, speech, auditory, visual systems and the limbic system
   • Brainstem, including white matter tracts and grey matter nuclei
   • Cerebellum
   • Ventricular system and cerebrospinal fluid (CSF) cisterns
   • Pituitary gland and related structures
   • Cranial nerves and their nuclei
   • Meninges and associated spaces
   • Vascular supply to the brain – arterial and venous vessels and dural venous sinuses.

4.1.2 Outline the embryological development of:
   • Circle of Willis
   • Dural venous sinuses and cerebral veins
   • Pituitary gland.

4.1.3 Describe the normal anatomical variants, including but not limited to:
   • Circle of Willis
   • Dural venous sinuses and cerebral veins
   • Ventricular system and basal cisterns
   • Pituitary gland.
4.2 HEAD AND NECK

By completion of training, the trainee will be able to:

4.2.1 Identify and describe the radiological anatomy of the following structures on all relevant imaging modalities:

- Cranial vault including bones, scalp and neurovascular and lymphatic supply
- Anterior, middle and posterior cranial fossae, skull base, foramina and contents
- Facial bones, sutures and foramina
- Temporal bone and surrounding structures including external ear, middle ear and inner ear
- Orbit including boundaries, compartments, contents and neurovascular and lymphatic supply
- Nasal cavity and paranasal sinuses including bones and foramina / canals and neurovascular and lymphatic supply
- Oral cavity including tongue, salivary glands, neurovascular and lymphatic supply
- Mandible and temporomandibular joint
- Teeth
- Superficial face
- Fasciae and spaces of the neck
- Muscles of the neck
- Trachea and larynx including spaces, cartilages and neurovascular and lymphatic supply
- Pharynx including divisions, pharyngeal muscles, neurovascular and lymphatic supply
- Thyroid and parathyroid glands including neurovascular and lymphatic supply
- Temporal, infra-temporal and pterygopalatine fossae contents and boundaries
- Major vessels and nerves of the head and neck
- Lymphatics and lymph nodes of the neck including nodal levels.

4.2.2 Outline the embryological development of:

- Thyroid and parathyroid glands
- Branchial clefts and sinuses.

4.2.3 Describe the normal anatomical variants of the structures of the head and neck, including but not limited to:

- Paranasal sinuses
- Neck vessels
- Thyroid and parathyroid glands.
4.3 SPINE

By completion of training, the trainee will be able to:

4.3.1 Identify and describe the radiological anatomy of the following on all relevant imaging modalities:
   • Vertebrae, sacrum and associated joints
   • Neurovascular and lymphatic supply of the spine
   • Paraspinal muscles and ligaments
   • Spinal cord, including structure, spinal grey matter, spinal white matter tracts, functional systems, cauda equina and nerve roots
   • Spinal meninges and spaces
   • Vascular supply to the spinal cord – arterial and venous.

4.3.2 Outline the embryological development of the vertebrae and spinal cord.

4.3.3 Describe the normal anatomic variants of the spine, including but not limited to:
   • Vertebrae including segmentation
   • Spinal cord including blood supply
   • Caudal equina and nerve roots.

4.4 THORAX

By completion of training, the trainee will be able to:

4.4.1 Identify and describe the radiological anatomy of the following structures on all relevant imaging modalities:
   • Chest wall including muscles, ligaments and bones, as well as neurovascular and lymphatic supply
   • Muscles of the thorax
   • Mediastinum including its subdivisions
   • Mediastinal viscera including heart chambers, structure, neurovascular and lymphatic supply
   • Major vessels and nerves of the thorax
   • Pericardium and pericardial spaces
   • Tracheobronchial tree and lungs including divisions, structure, neurovascular and lymphatic supply
   • Pleura and pleural spaces
   • Lymphatics and lymph nodes of the thorax
   • Diaphragm including attachments, hiatuses and neurovascular supply.

4.4.2 Outline the embryological development of:
   • Aorta
   • Superior vena cava
   • Pulmonary vasculature.

4.4.3 Describe the normal anatomic variants of the thorax, including but not limited to:
   • Coronary vascular supply
   • Great vessels
   • Pulmonary vasculature
   • Lungs, pleura and tracheobronchial tree.

4.4.4 Identify and describe the radiological anatomy of the breast including neurovascular and lymphatic supply.

4.4.5 Describe the embryologic development of the breast and normal anatomical variants of the breast including neurovascular and lymphatic supply.
4.5 ABDOMEN AND PELVIS

By completion of training, the trainee will be able to:

4.5.1 Identify and describe the radiological anatomy of the following structures on all relevant imaging modalities:

- Anterolateral and posterior abdominal walls including muscles, ligaments and bones, as well as neurovascular and lymphatic supply
- Bones of the abdomen and pelvis
- Muscles of the abdomen and pelvis
- Pelvic floor and perineum including fascia, pelvic ligaments and the urogenital and anal triangles
- Major vessels and nerves of the abdomen and pelvis
- Peritoneum, peritoneal reflections, boundaries and spaces
- Retroperitoneum, divisions, boundaries and contents
- Hollow viscera including neurovascular and lymphatic supply
- Solid viscera including neurovascular and lymphatic supply
- Hepatopancreatobiliary system including neurovascular and lymphatic supply
- Genitourinary structures including neurovascular and lymphatic supply, as well as the external genitalia
- Lymphatics and lymph nodes of the abdomen and pelvis.

4.5.2 Outline the embryological development of:

- Foregut, midgut and hindgut including the solid organs related to the dorsal and ventral mesogastrium
- Inguinal canal and scrotum
- Urogenital tracts of the male and female
- Abdominal aorta and inferior vena cava.

4.5.3 Describe the normal anatomic variants of the structures in the abdomen and pelvis, including but not limited to:

- Major arteries and veins
- Major splanchnic arteries and veins
- Biliary tree
- Hepatic vasculature
- Pancreas and pancreatic ducts
- Urogenital tracts of the male and female.

4.5.4 Recognise and describe the radiological anatomy of the placenta and maternal-foetal circulation.
4.6 UPPER AND LOWER LIMBS

By completion of training, the trainee will be able to:

4.6.1 Identify and describe the radiological anatomy of the following on all relevant imaging modalities:
   - Bones and joints including ligaments and intra-articular structures
   - Normal development of the major bones, including ossification of physes
   - Muscles and tendons including description of their actions
   - Cervical, brachial, lumbar and sacral plexuses
   - Major vessels of the limbs including course, branches and distribution
   - Major nerves of limbs including segmental derivation, course, branches and distribution
   - Lymphatics and lymph nodes of the limbs
   - Anatomical spaces within the upper and lower limbs including but not limited to the axilla, cubital fossa, carpal tunnel, femoral triangle, popliteal fossa and tarsal tunnel.

4.6.2 Describe the normal embryological development of the major bone, including ossification of physes, carpals and tarsals.

4.6.3 Describe the normal anatomic variants of the upper and lower limbs, including but not limited to:
   - Accessory ossicles, bony and ligamentous variants
   - Vascular variants.
Section Five
PATHOLOGY
SECTION FIVE
PATHOLOGY

Refer to the clinical conditions list in Appendix 1

5.1 GENERAL PATHOLOGY

By completion of training, the trainee will be able to:

5.1.1 Explain and describe the cellular adaptations of growth and differentiation including hyperplasia, hypertrophy, atrophy, metaplasia.
5.1.2 Explain and describe cell injury and cell death including necrosis and apoptosis.
5.1.3 Describe intracellular accumulations and recognise their relevance in pathological conditions including lipids, proteins, glycogen, pigments.
5.1.4 Explain the causes of pathological calcification and describe the associated morphological changes.
5.1.5 Discuss the pathological basis of acute and chronic inflammation.
5.1.6 Explain the pathological processes of regeneration, repair and scar formation, fibrosis and healing in specialised tissue (e.g. healing of a fracture).
5.1.7 Discuss and describe the pathological basis of haemodynamic disorders, thromboembolic disease and shock, then expand to cover following systemic disorders:
   • Oedema and effusions
   • Hyperaemia and congestion
   • Haemorrhagic disorders
     • Defects of primary haemostasis (platelets)
     • Defects of secondary haemostasis (coagulation factors).
   • Thrombosis
   • Disseminated intravascular coagulation
   • Embolism
   • Infarction
   • Shock.
5.1.8 Define and describe the pathological basis of conditions of the immune system such as hypersensitivity reactions, autoimmune diseases, immunodeficiency syndromes and amyloidosis, then expand to cover the following systemic disorders:
   • Systemic lupus erythematosus
   • Systemic sclerosis (scleroderma)
   • Vasculitis
     • Large vessel: Giant cell (temporal) arteritis, Takayasu arteritis
     • Medium vessel: polyarteritis nodosa, Kawasaki disease
     • Small vessel: granulomatosis with polyangiitis, Churg-Strauss syndrome.
   • IgG4-related disease
   • Rejection of tissue transplants
   • Acquired immunodeficiency syndrome (AIDS)
   • Amyloidosis.
5.1.9 Define tumours according to contemporary tumour nomenclature and be familiar with current classification and staging systems.
5.1.10 Identify characteristics of benign and malignant tumours (e.g. degree of cellular differentiation, presence and degree of local invasion, presence of metastatic disease and pathways of spread).

5.1.11 Recognise and describe the clinical aspects of neoplasia including local effects, hormonal effects and paraneoplastic syndromes.

5.1.12 Outline the relevance of commonly used tumour markers. Describe the pathological changes associated with infections.

5.1.13 Recognise the pathological consequences of, and describe the morphological changes associated with:
- Radiation injury
- Obesity
- Diabetes mellitus
- Tobacco
- Alcohol
- Adverse drug reactions
- Occupational exposures
- Drug abuse
- Poisons
- Nutritional deficiencies.
Section Six
DIAGNOSTIC RADIOLOGY
SECTION SIX
DIAGNOSTIC RADIOLOGY

Refer to the clinical conditions list in Appendix 2

Overview
This section of the learning outcomes defines the competencies that trainees are expected to attain in relation to the daily practice of diagnostic and clinical radiology.

It represents a culmination of skills, knowledge and attitudes that enable the trainee to facilitate the safe practice of diagnostic radiology. This should span the continuum of patient care from receipt of an imaging referral to the diagnostic report and any subsequent role in patient management.

The general diagnostic learning objectives refer to the following radiological studies (including advanced imaging techniques):
- X-ray
- Ultrasound (US)
- Computer tomography (CT) scan
- Magnetic resonance imaging (MRI) scan
- Nuclear medicine (NM) scans
- Mammography
- Bone mineral densitometry (BMD).
6.1 GENERAL DIAGNOSTIC RADIOLOGY

By the completion of training, the trainee will be able to:

Safe Clinical Practice
6.1.1 For all imaging modalities used to diagnose and evaluate abnormalities:
• Describe the principles, indications, advantages and disadvantages, limitations and contraindications for use
• Outline specific protocols.
6.1.2 Discuss imaging studies or procedures with the referring doctor, ensuring the examinations are optimised to support and assist in treatment decisions.
6.1.3 Prioritise imaging requests based on clinical urgency.
6.1.4 Ensure that the imaging request is appropriate for a patient's clinical issues.
6.1.5 Consider the clinical information associated with the patient's presentation, construct a differential diagnosis and facilitate or recommend the most appropriate imaging pathway.
6.1.6 Explain and justify the imaging pathway best suited to facilitate a diagnosis for a clinical condition with reference to:
• Detailed knowledge of imaging modalities (refer to Applied Imaging Technology)
• A working knowledge of pathology (refer to Pathology)
• Principles of evidence-based practice.
6.1.7 Discuss indications and contraindications for imaging studies with clinicians and patients.
6.1.8 Advocate for investigations that minimise risk and radiation exposure to the patient.
6.1.9 Describe the pharmacokinetics, indications, contraindications and possible complications of using different types of contrast agent.
6.1.10 Recognise the risks associated with particular imaging modalities and associated contrast agents and justify their use.
6.1.11 Explain the nature of potential adverse events, such as allergic reactions, to patients and take any necessary precautions as required.
6.1.12 Facilitate the performance of appropriate imaging examinations.
6.1.13 Adhere to safety protocols to minimise risk while protecting patients from harm.
6.1.14 Promote high standards of diagnosis, management and safety for patients, ensuring imaging protocols, image interpretation and procedures are conducted optimally.
6.1.15 Maintain responsibility for patient care throughout the diagnostic imaging process.
6.1.16 Manage complications related to the process of image acquisition (e.g. contrast reaction or extravasation).
6.1.17 Explain the reasoning behind additional investigative options, should this be required after initial examinations have been conducted.
6.1.18 Recognise the role of non-imaging investigations and incorporate them into practice.
6.1.19 Ensure a medical and operational handover for patients where their imaging is incomplete and/or an ongoing imaging investigation, particularly if they are critically ill.
**Image Interpretation**

6.1.20 Synthesise any relevant patient information from multiple sources (including previous imaging or medical records) to establish a better understanding of their current imaging.

6.1.21 Conduct a quality assessment of the images.

6.1.22 Perform a thorough and systematic review of the imaging examination and perceive abnormalities.

6.1.23 Recognise and correctly interpret artefacts associated with all imaging modalities.

6.1.24 Apply knowledge of anatomy (**refer to Anatomy**) and pathology (**refer to Pathology**) and identify abnormalities, taking into consideration:

- The range of normal variants (especially those that mimic disease)
- Changing appearance with age
- Physiological states
- Morphological changes of pathological tissues.

6.1.25 Integrate a broader knowledge of clinical presentations, imaging appearances and pathology to form an appropriate diagnosis and/or differential diagnosis.

6.1.26 Recognise findings that constitute a medical emergency to expedite and implement local management protocols.

6.1.27 Communicate relevant findings to referrers and patients when appropriate, including diagnoses and their implications.

6.1.28 Directly communicate with the referrer in cases that have urgent clinical priority, findings of malignancy requiring treatment, or diagnoses that have the potential to harm others.

6.1.29 Communicate unexpected or significant findings in a timely and appropriate manner, according to clinical urgency, and confirming receipt of the findings.

**Image Reporting**

6.1.30 Apply the **Clinical Radiology Report Writing Guidelines** when formulating reports on imaging studies.

6.1.31 Utilise professional medical language which is clear and matches the referrer’s expected level of knowledge.

6.1.32 Confidently use terminology which is widely understood and has a commonly agreed meaning among medical and allied health practitioners.

6.1.33 Utilise contemporary guidelines for the staging, monitoring and reporting of benign and malignant disease.

6.1.34 Assign class of diagnosis (e.g. benign/ normal variant/ probable malignancy/ significant abnormality) and direct further investigations where required.

6.1.35 Convey expert opinion, degree of certainty in the diagnosis, and its implications effectively. Respond to error in reporting with a professional approach to amending reports.

6.1.36 Provide the opportunity for the referring doctor to discuss the imaging findings in all cases.
6.2 BRAIN

By the completion of training, the trainee will be able to:

Specific imaging and interpretation of the brain
General learning outcomes for diagnostic radiology are listed at the start of this section. In addition, further learning outcomes are provided below specific to the imaging of the brain.

CT
6.2.1 Interpret and explain:
- CT venography
- CT perfusion.

MRI
6.2.2 Discuss the basic principles and utility of MR diffusion and MR perfusion.
6.2.3 Discuss MR spectroscopy and blood oxygenation level dependent (BOLD) functional MRI.

Nuclear Medicine
6.2.4 Demonstrate knowledge of the principles, indications and limitations for SPECT and PET-CT scans in neuroradiology imaging.
6.2.5 Discuss tracer options for neuroradiology imaging (e.g. fluorodeoxyglucose (FDG), fluoroethyl-L-tyrosine (FET) and dodecane tetaacetic acid (DOTATATE)).

Non-Radiological Interventions
6.2.6 Discuss the role of investigations such as EEG, nerve conduction studies and CSF examination.

6.3 HEAD AND NECK

By the completion of training, the trainee will be able to:

Specific imaging and interpretation of the head and neck
General learning outcomes for diagnostic radiology are listed at the start of this section. In addition, further learning outcomes are provided below specific to imaging of the head and neck.

X-Ray
6.3.1 Interpret orthopantomogram (OPG).

CT
6.3.2 Plan CT for functional endoscopic sinus surgery.
6.3.3 Supervise and interpret a 4D assessment of the parathyroid glands.
6.3.4 Discuss the advantages and disadvantages of cone beam CT in head and neck, ENT and dental imaging.

Nuclear Medicine
6.3.5 Demonstrate knowledge of the principles, indications and limitations for PET-CT scans in head and neck imaging.
6.3.6 Demonstrate knowledge of the principles, indications and limitations for the following nuclear medicine studies:
- Sestamibi scan (for detecting parathyroid adenoma)
- Thyroid scan (for evaluation of thyroid disorders)
- Gallium-67 scan (for evaluation of infection)
- Bone scan including SPECT.

Non-Radiological Investigations
6.3.7 Discuss the role of endoscopy for head and neck conditions.
6.4 **SPINE**

*By the completion of training, the trainee will be able to:*

**Specific imaging and interpretation of the spine**

General learning outcomes for diagnostic radiology are listed at the start of this section. In addition, further learning outcomes are provided below specific to the imaging of the spine.

**X-Ray**
6.4.1 Interpret and describe curvature abnormalities of the spine including dynamic assessment.
6.4.2 Perform an assessment of stability.

**CT**
6.4.3 Discuss the utility of and interpret CT myelography.

**MRI**
6.4.4 Discuss the utility of in/out of phase imaging.
6.4.5 Discuss the utility of diffusion imaging.

**Nuclear Medicine**
6.4.6 Demonstrate knowledge of the principles, indications and limitations for the following nuclear medicine scans in spine imaging:
- PET-CT scan (including the commonly used tracers such as FDG, Neuroendocrine imaging (DOTATE) & prostate-specific membrane antigen (PSMA))
- Bone scan including SPECT
- Gallium-67 scan i.e. infection.

**Non-Radiological investigations**
6.4.7 Discuss the role of other investigations such as electrophysiology and CSF analysis.

6.5 **CARDIOTHORACIC**

*By the completion of training, the trainee will be able to:*

**Specific imaging and interpretation of the thorax**

General learning outcomes for diagnostic radiology are listed at the start of this section. In addition, further learning outcomes are provided below specific to cardiothoracic imaging.

**Ultrasound**
6.5.1 Perform thoracic ultrasound to diagnose pleural effusions and plan image-guided pleural aspiration and drainage.

**CT**
6.5.2 Discuss the principles of and interpret high-resolution chest CT (HRCT).
6.5.3 Protocol and report CT coronary angiography (CTCA).

**MRI**
6.5.4 Discuss strengths and weaknesses of MRI in cardiothoracic disease.
6.5.5 Recognise common pathologies such as aortic dissection on common sequences.

**Nuclear Medicine**
6.5.6 Identify pulmonary emboli on VQ scans (including the addition of SPECT) and outline the role of the technique in diagnosing pulmonary thromboembolic disease.
6.5.7 Describe the use of PET-CT scan and its role in staging pulmonary malignancy.

**Population Screening**
6.5.8 Discuss the role of low-dose CT screening for lung cancer.
6.5.9 Discuss the role of (CXR) and CT screening for occupational lung disease.

**Non-Radiological Investigations**
6.5.10 Discuss the role of lung function tests in diffuse lung disease.
6.6 ABDOMEN AND PELVIS

By the completion of training, the trainee will be able to:

Specific imaging and interpretation of the abdomen and pelvis

General learning outcomes for diagnostic radiology are listed at the start of this section. In addition, further learning outcomes are provided below specific to imaging of the abdomen and pelvis.

Ultrasound
6.6.1 Perform and interpret a Doppler assessment of abdominal vasculature and viscera.
6.6.2 Demonstrate knowledge of the indications, principles and limitations of contrast enhanced ultrasound of abdominal viscera.
6.6.3 Discuss the principles behind focused assessment with sonography for trauma (FAST) scanning and interpret images.

CT
6.6.4 Protocol, perform and report:
• CT colonography.

MRI
6.6.5 Protocol and report:
• Liver specific contrast studies
• Magnetic resonance cholangiopancreatography (MRCP).

Nuclear Medicine
6.6.6 Demonstrate knowledge of the principles, indications and limitations for the following nuclear medicine examinations of the abdomen:
• Gastrointestinal (GIT) bleeding study
• Meckel scans
• Diethylene triamine pentaacetic acid (DTPA) / dimercaptosuccinic acid (DMSA) / mercaptoacetyltriglycine (MAG III) scan
• Meta-iodobenzylguanidine (MIBG)
• PET-CT scan, including FDG, neuroendocrine (i.e. DOTA-TATE) and PMSA PET tracers.

Non-Radiological Investigations
6.6.7 Discuss the role of investigations such as endoscopy, colonoscopy, capsular endoscopy and manometry.

6.7 MUSCULOSKELETAL SYSTEM

By the completion of training, the trainee will be able to:

Specific imaging and interpretation of the musculoskeletal system

General learning outcomes for diagnostic radiology are listed at the start of this section. In addition, further learning outcomes are provided below specific to imaging of the musculoskeletal system.

Ultrasound
6.7.1 Perform and interpret ultrasound of the three major upper and lower joints, muscles, tendons and ligaments.

MRI
6.7.2 Understand the indications for, contraindications and interpret MR arthrography.

Nuclear Medicine
6.7.3 Discuss the role of nuclear medicine in musculoskeletal disease, i.e. infection and tumour.
6.7.4 Discuss how to perform a bone scan (including addition of SPECT), consider its major limitations and interpret the scan.

Bone Mineral Densitometry (BMD)
6.7.5 Explain and interpret BMD scans.
6.8 OBSTETRICS AND GYNAECOLOGY

By the completion of training, the trainee will be able to:

Specific imaging and interpretation for obstetrics and gynaecology

General learning outcomes for diagnostic radiology are listed at the start of this section. In addition, further learning outcomes are provided below specific to imaging of obstetrics and gynaecology.

**Ultrasound**
6.8.1 Perform and interpret female pelvic ultrasound.
6.8.2 Explain the principles of routine screening for obstetric abnormality in the first and second trimester.
6.8.3 Perform and interpret obstetric ultrasound, including ultrasound in 1st, 2nd and 3rd trimesters of pregnancy.
6.8.4 Discuss the role of uterine artery dopplers.

**CT**
6.8.5 Interpret CT scanning of gynaecological pathology.

**MRI**
6.8.6 Discuss the role of MRI of the foetus and in Placenta Accreta spectrum.
6.8.7 Discuss the role of MRI in gynaecology disorders, including deep endometriosis.

**Nuclear Medicine**
6.8.8 Demonstrate knowledge of the principles, indications and limitations of PET-CT scan in staging of gynaecological malignancy.
6.8.9 Discuss the role of VQ scan in diagnosing pulmonary thromboembolic disease in pregnancy and postpartum patients (including technique, diagnostic accuracy, limitation, radiation risk and availability).

**Non-Radiological Investigations**
6.8.10 Discuss the role of other investigations such as first and second trimester screening investigations for aneuploidy and neural tube defect, non-invasive pre-natal testing (NIPT), chorionic villous sampling and amniocentesis.
6.9 BREAST

By the completion of training, the trainee will be able to:

Specific imaging and interpretation for the breast
General learning outcomes for diagnostic radiology are listed at the start of this section. In addition, further learning outcomes are provided below specific to imaging of the breast.

Mammography
6.9.1 Explain the distinction between screening and diagnostic mammography, including the rationale for double reading in screening mammography.
6.9.2 Interpret and explain mammographic features of benign and malignant disease. Interpret breast tomosynthesis.
6.9.3 Demonstrate knowledge of contrast mammography.

Ultrasound
6.9.4 Perform and interpret breast ultrasound to differentiate benign from malignant disease.
6.9.5 Discuss the role of ultrasound for breast cancer screening of dense breasts.

MRI
6.9.6 Interpret and explain:
   • MRI differentiation between benign and malignant disease
   • Breast implant MRI.
6.9.7 Discuss the role of MRI in breast cancer screening in high risk women.

Nuclear Medicine
6.9.8 Outline the indications/contraindications for PET/CT in breast cancer imaging.
6.9.9 Discuss the accuracy of PET or PET/CT compared with other modalities.

Population Screening
6.9.10 Discuss:
   • Principles of mammographic screening
   • Evidence for population screening
   • Population vs. sporadic screening
   • Mammographic and MRI screening for high risk women.

Non-Radiological Investigations
6.9.11 Discuss the role of investigations such as testing for BRCA-1 and BRCA-2 genes.
6.9.12 Explain the importance of hormone receptor markers in breast cancer.
6.10  PAEDIATRIC

By the completion of training, the trainee will be able to:

Specific imaging and interpretation for paediatrics

General learning outcomes for diagnostic radiology are listed at the start of this section. In addition, further learning outcomes are provided below specific to paediatric imaging.

Ultrasound

6.10.1 Perform and interpret neonatal cranial and spine ultrasound.
6.10.2 Perform and interpret hip ultrasound.

CT

6.10.3 Interpret CT for congenital heart disease, vascular rings and airway anomalies.

MRI

6.10.4 Protocol and interpret a broad range of MRI studies in the paediatric population, including:
   - Brain and spine
   - Abdomen
   - Musculoskeletal.

Nuclear Medicine

6.10.5 Demonstrate knowledge of the principles, limitations and indications for
   - DTPA / DMSA / MAG III scan
   - HIDA scan for biliary dysfunction
   - MIBG scan for neuroblastoma
   - PET-CT scans for paediatric tumours including tracers such as FDG and DOTATATE
   - VQ scan for airway anomalies and perfusion
   - Thyroid scan for thyroid anomalies.

6.11  GENETIC SYNDROMES

By the completion of training, the trainee will be able to:

Specific imaging and image interpretation for systemic medical conditions

General learning outcomes for diagnostic radiology are listed at the start of this section. There are no additional outcomes specific to this topic area.
Section Seven
PROCEDURAL RADIOLOGY
SECTION SEVEN
PROCEDURAL RADIOLOGY

Overview
This section of the learning outcomes defines the competencies that trainees are expected to attain in relation to the daily practice of procedural clinical radiology.

It represents a culmination of skills, knowledge and attitudes that enable the trainee to facilitate the safe practice of basic procedural radiology. This should span the continuum of patient care from receipt of an imaging referral to the diagnostic report and any subsequent role in patient management.

The general procedural learning objectives refer to diagnostic and therapeutic procedures performed under the following radiological guidance:

• Fluoroscopy
• Ultrasound
• Computed tomography (CT)
• Magnetic resonance imaging (MRI)
• Mammography
• Angiography.
7.1 GENERAL PROCEDURAL RADIOLOGY

By the completion of training, the trainee will be able to:

Risk Assessment and Informed Consent (NB: Some of the below may take place in a pre-procedural consultation)

7.1.1 Discuss the clinical significance of pathologies requiring radiological intervention.
7.1.2 Determine patients' suitability for diagnostic and therapeutic interventional procedures, after considering indications, contraindications and risks as well as a review of relevant prior imaging.
7.1.3 Assess the urgency of the clinical situation. Determine optimal imaging guidance.
7.1.4 Identify the radiation and safety requirements for the procedure.
7.1.5 Conduct a thorough pre-procedure assessment to identify patient conditions that may affect the safety and/or effectiveness of the procedure:
   - Age-related risks including pregnancy status
   - Allergies and possible reactions to contrast agents
   - Medications, including anticoagulation
   - Need for analgesia or sedation
   - Historical or current medical conditions (e.g. diabetes, renal dysfunction, haematological, coagulopathy)
   - Anxiety
   - Other possible contraindications.
7.1.6 Address any risks identified by implementing suitable protocol or recommend the intervention is not undertaken.
7.1.7 Ensure and document that the patient has received information (preferably verbally and written) about the procedure with sufficient time to consider the intervention and any possible alternatives.
7.1.8 Discuss the procedures, including the possible risks involved and expected outcomes and check patient understanding to confirm informed consent.
7.1.9 Document patient consent in medical records.

Infection Control

7.1.10 Demonstrates knowledge and application of infection control guidelines, including:
   - Handwashing
   - Use of personal protective equipment (PPE)
   - Reprocessing of instruments and equipment
   - Set up of sterile trays
   - Systems for handling blood, other body fluids, nonintact skin and mucous membranes
   - Disinfection of equipment and instruments
   - Needle and waste disposal.
7.1.11 Demonstrates application of additional precautions to prevent the transmission of infectious disease.
7.1.12 Be aware of notifiable diseases which must be reported and inform the relevant local public health unit or national authority.
Image guided interventions for procedural radiology

7.1.13 Discuss the practice and principles of imaging guidance.
7.1.14 Select appropriate imaging guidance to perform interventions or procedures.
7.1.15 Apply knowledge of anatomy (refer to section Four – Anatomy) that is relevant to conducting the intervention or procedure, including but not limited to:
   - Surface imaging anatomy
   - Arterial and venous anatomy
   - Peritoneal anatomy
   - Urinary tract anatomy
   - Biliary anatomy
   - Spinal and central nervous system anatomy

7.1.16 Utilise the following core skills under image guidance (US, CT, fluoroscopy, MRI, Angiography, Mammography):
   - Aspiration, biopsy techniques and injections – lesion/solid organ
   - Drain insertion techniques including fixation, monitoring, maintenance and removal
   - Vascular access techniques (venous – peripherally inserted central catheter (PICC), central venous line, arterial) including management of puncture sites and related complications.

7.1.17 Discuss the principles of blood coagulation and appropriately manage abnormalities of coagulation in relation to biopsies or interventional procedures.
7.1.18 Describe the effect of drugs (e.g. aspirin, clopidogrel and other anticoagulants) in relation to biopsies and interventional procedures.
7.1.19 Document procedure and detail post-procedural care in notes, including any post-procedural instructions or recommendations for further imaging or intervention.
7.1.20 Document and communicate any procedural complications to the referring doctor, patient/family and ensure appropriate follow-up.
7.1.21 Communicate any unexpected or urgent results direct to the referring doctor, patient/family and ensure appropriate follow-up.
7.1.22 Ensure there is appropriate medical and operational handover between attending radiology staff including between different staff shifts.
Safe Sedation

7.1.23 Conduct a thorough pre-sedation assessment of a patient, identifying clinical features, pre-existing conditions and medications that predispose patients to adverse sedation-related events.

7.1.24 Stratify patients according to risk and refer those patients at high risk of adverse sedation-related events to a specialist anaesthetist.

7.1.25 Determine the requirements for analgesia and/or anxiolysis before the procedure, taking into account the complexity and likely discomfort of the procedure for the patient.

7.1.26 Clearly communicate the risks of procedural sedation to the patient (in addition to risks associated with the procedure itself), to obtain valid informed consent and address patient expectations.

7.1.27 Prepare for an episode of procedural sedation ensuring that:
- Equipment for monitoring and for emergencies is available and functional in both the procedure and recovery areas
- The minimum recommended staff are present during the procedure and in the recovery area and all have current basic life support skills
- At least one clinical staff member present is current in advanced life support skills and is immediately available in the event of an emergency
- Drugs for sedation and emergencies are immediately available
- All team members have a shared understanding of their responsibilities and the patient care plan, including emergency protocols.

7.1.28 Discuss the pharmacology of drugs used intravenously for procedural sedation. Describe how the use of multiple drugs may produce synergistic or antagonistic effects.

7.1.29 Describe the pharmacology of reversal and antagonist agents, and drugs used for the management of medical emergencies, including indications, duration of action and risks of use.

7.1.30 Administer sedation and analgesic drugs, titrating them to effect, taking into consideration the differing onset times, doses, peak effects and duration, to ensure completion of the entire procedure.

7.1.31 Continually monitor patient comfort and record regular observations, according to local guidelines.

7.1.32 Recognise the deteriorating patient, initiate management or rescue and call for help if required.

7.1.33 Ensure the patient is safe to be transferred to a recovery area and a formal handover of care, along with documentation of the sedation and plan for ongoing care, is completed.

7.1.34 Ensure continual observation and monitoring of the patient in the recovery area until the patient meets pre-defined criteria for discharge.

7.1.35 Ensure written discharge information is provided for all patients before they leave the facility with their carer, including instructions for steps to take in the event of an emergency.

7.1.36 Refer to the Australian and New Zealand College of Anaesthetists (ANZCA) Guidelines on Sedation and/or Analgesia for Diagnostic and Interventional Medical, Dental or Surgical Procedures.

PROCEDURAL RADIOLOGY TOPIC AREAS

General learning outcomes for procedural radiology are listed at the start of this section. In addition, further learning outcomes are provided below specific to topic areas.

The procedures and interventions a trainee is expected to be able to discuss, prepare for interpret and/or perform, relevant to the topic area, are outlined below.

As part of the procedural radiology work based assessment, trainees are required to perform and record 100 interventional procedures under radiological guidance across the three phases of training. At least 15 of each major procedure category is required, ideally maintaining an even spread across the four major categories, these are:
- Injection
- Drainage
- Biopsy
- Vascular access

These learning outcomes are in addition to the General Procedural Radiology learning outcomes listed at the start of this section.
7.2 **BRAIN**

*By the completion of training, the trainee will be able to:*

7.2.1 Discuss the indications, contraindications, limitations and potential complication and interpret, discuss and report on results of the following:
   a) **Diagnostic**
      - Cerebral angiography – catheter
      - Carotid and vertebral artery angiography – catheter.
   b) **Therapeutic**
      - Carotid and vertebral artery angioplasty/stent placement
      - Intracranial aneurysm repair and management of subarachnoid haemorrhage
      - Intracranial vascular malformation embolisation (pial, dural)
      - Emergency stroke therapy – thrombectomy / thrombolysis
      - Preoperative tumour embolisation.

7.3 **HEAD AND NECK**

*By the completion of training, the trainee will be able to:*

7.3.1 Discuss the indications, contraindications, limitations and potential complications, and perform, interpret, discuss and report on results of the following:
   a) **Diagnostic**
      - Biopsy: percutaneous – lymph node, tumour
      - Fluoroscopic contrast studies (e.g. contrast swallow).
   b) **Therapeutic**
      - Drainage catheter placement: percutaneous.

7.3.2 Discuss the indications, contraindications, limitations and potential complications and interpret, discuss and report on results of the following:
   a) **Diagnostic**
      - Carotid and vertebral artery angiography – catheter
      - External carotid angiography
      - Dacrocystogram
      - Sialography.
   b) **Therapeutic**
      - Central venous catheter placement
      - Carotid and vertebral artery angioplasty/stent placement
      - Endovascular aneurysm/dissection/trauma repair
      - Embolisation: hypervascular tumour/epistaxis
      - Percutaneous vascular malformation/tumour management – venolymphatic, cystic hygroma
      - Chemo-embolisation.
7.4 SPINE AND NERVOUS SYSTEM

By the completion of training, the trainee will be able to:

7.4.1 Discuss the indications, contraindications, limitations and potential complications, and perform, interpret, discuss and report on results of the following:
   a) Diagnostic
      • Lumbar puncture including measurement of spinal CSF pressure.
   b) Therapeutic
      • Percutaneous Pharmaceutical Interventions (e.g. epidural, nerve sheath, facet joint blocks)
     • Drainage catheter placement: percutaneous.

7.4.2 Discuss the indications, contraindications, limitations and potential complications, and interpret, discuss and report on results of the following:
   a) Diagnostic
      • Myelography +/- CT
     • Spinal angiography – catheter
     • Biopsy: percutaneous.
   b) Therapeutic
      • Endovascular embolisation – preoperative tumour embolisation, vascular malformation
     • Vertebroplasty / kyphoplasty
     • Radiofrequency ablation (RF/RFA) and cryoablation
     • Autonomic nerve blocks (e.g. Coeliac, Splanchnic, Lumbar plexus blocks or neurolysis).

7.5 CARDIOTHORACIC

By the completion of training, the trainee will be able to:

7.5.1 Discuss the indications, contraindications, limitations and potential complications and perform, interpret, discuss and report on results of the following:
   a) Diagnostic
      • Biopsy: percutaneous (e.g. pleural/lung/chest wall)
     • Fluoroscopic contrast studies (e.g. contrast swallow).
   b) Therapeutic
      • Peripherally inserted central venous catheter (PICC) placement
     • Drainage catheter placement: percutaneous.

7.5.2 Discuss the indications, contraindications, limitations and potential complications and interpret, discuss and report on results of the following:
   a) Diagnostic
      • Biopsy: transbronchial
     • Cardiac angiography – catheter
     • Pulmonary/bronchial angiography – catheter
     • Lymphangiography.
   b) Therapeutic
      • Central venous catheter placement
     • Balloon angioplasty/stent – aortic stent grafting
     • Endovascular aneurysm repair: aortic
     • Embolisation: hypervascular tumour/vascular malformation/haemoptysis
     • Thrombolysis/thrombectomy: Pulmonary embolus
     • Ablative (chemoembolisation, radioembolisation, radiofrequency ablation (RF/RFA), cryoablation, microwave ablation).
7.6  ABDOMEN AND PELVIS

By the completion of training, the trainee will be able to:

7.6.1 Discuss the indications, contraindications, limitations and potential complications and perform, interpret, discuss and report on results of the following:

   a) Diagnostic
      • Biopsy: percutaneous – solid organ (targeted or non targeted), peritoneal or retroperitoneal, soft tissue
      • Fluoroscopic contrast studies:
         • Contrast swallow, meal, follow through, enema
         • Urethrogram
         • Cystogram
         • Micturating cystourethrogram (MCU)
         • Tubograms
         • Fistulogram
         • Common bariatric examinations – lap band/ sleeve/ bypass checks.

   b) Therapeutic
      • Drainage catheter placement – percutaneous
      • Radiologically inserted nasogastric tube, nasojejunal, naso-duodenal tube.

7.6.2 Discuss the indications, contraindications, limitations and potential complications, and interpret, discuss and report on results of the following:

   a) Diagnostic
      • Biopsy – transvenous (liver)
      • Angiography – aortoiliac, coeliac (hepatic/splenic) and mesenteric studies, renal, lumbar
      • Venography
      • Nephrostogram
      • Cholangiogram.

   b) Therapeutic
      • Drainage catheter placement: trans-rectal, or trans-vaginal, abscess drainage, cholecystostomy
      • Balloon angioplasty/stent – aortoiliac stent grafting
      • Endovascular aneurysm repair
      • Embolization: tumour (benign or malignant), haemorrhagic lesions, trauma, thoracic duct
      • Inferior vena cava (IVC) filters – insertion/retrieval
      • Trans-jugular intrahepatic portosystemic shunts (TIPS)
      • Biliary intervention – percutaneous transhepatic cholangiography (PTC) and drainage
      • Radiologically inserted gastrostomy or jejunostomy
      • Stricture dilatation and stenting
      • Nephrostomy
      • Antegrade ureteric stent insertion
      • Prostate biopsy
      • Varicocele embolisation
      • Ablative (chemoembolisation – hepatic, radioembolisation – hepatic , radiofrequency ablation (RF/RFA), cryoablation, microwave ablation)
      • Percutaneous sclerotherapy/injection of sclerostant.

   c) Dialysis related interventions (included here for convenience):
      • Placement of tunneled haemodialysis catheters
      • Peritoneal dialysis catheters
      • Revision/thrombolysis of poorly functioning surgically placed arteriovenous (AV) fistulas and grafts
      • Fistulography.
7.7 MUSCULOSKELETAL SYSTEM

By the completion of training, the trainee will be able to:

7.7.1 Discuss the indications, contraindications, limitations and potential complications, and perform, interpret, discuss and report on results of the following:
   a) Diagnostic
      • Arthrography +/- CT/MRI (large/small joint)
      • Biopsy: percutaneous.
   b) Therapeutic
      • Percutaneous Pharmaceutical Interventions - bursal (particular subacromial), large synovial joint, synovial sheaths, epidural, nerve sheath, facet joint, regional blocks (e.g. carpal tunnel)
      • Drainage catheter placement: percutaneous.

7.8 PERIPHERAL VASCULAR

By the completion of training, the trainee will be able to:

7.8.1 Discuss the indications, contraindications, limitations and potential complications, and interpret, discuss and report on results of the following:
   a) Diagnostic
      • Catheter angiography and venography.
   b) Therapeutic
      • Balloon angioplasty/stent placement
      • Endovascular aneurysm repair
      • Endovascular or percutaneous embolisation - tumour, vascular malformation
      • Endovenous laser treatment of varicose veins.

7.9 OBSTETRICS AND GYNAECOLOGY

By the completion of training, the trainee will be able to:

7.9.1 Discuss the indications, contraindications, limitations and potential complications, and perform, interpret, discuss and report on results of the following:
   a) Diagnostic
      • Biopsy – percutaneous.

7.9.2 Discuss the indications, contraindications, limitations and potential complications, and interpret, discuss and report on results of the following:
   a) Diagnostic
      • Hysterosalpingogram
      • Amniocentesis
      • Chorionic villus sampling
      • Saline infusion sonography.
   b) Therapeutic
      • Fallopian tube recanalisation
      • Lipiodol flush for subfertility
      • Uterine artery, adenomyosis and uterine fibroid embolisation
      • Drainage catheter placement – percutaneous.
7.10 BREAST

By the completion of training, the trainee will be able to:

7.10.1 Discuss the indications, contraindications, limitations and potential complications, and perform, interpret, discuss and report on results of the following:
   a) Diagnostic
      • US guided biopsy: percutaneous – fine-needled aspiration (FNA), core, vacuum assisted – lesion, lymph node.
   b) Therapeutic
      • Percutaneous aspiration – cysts/abscesses.

7.10.2 Discuss the indications, contraindications, limitations and potential complications, and interpret, discuss and report on results of the following:
   a) Diagnostic
      • Biopsy – percutaneous – FNA, core, vacuum assisted (stereotactic, tomosynthesis, MRI) – lesion, lymph node.
   b) Therapeutic
      • Hookwire insertion and other methods of localisation (e.g. radio-guided occult lesion localisation using iodine-125 seeds (ROLLIS), fiducial clips, carbon track)
      • Percutaneous sclerotherapy/injection of sclerosant (i.e. for seroma).
7.11 PAEDIATRICS

By the completion of training, the trainee will be able to:

7.11.1 Discuss the indications, contraindications, limitations and potential complications, and perform, interpret, discuss and report on results of the following:

a) Diagnostic
   • Fluoroscopic contrast studies:
     • GI contrast studies
     • Micturating cystourethograms (MCU)
     • Urethromgrams.

7.11.2 Discuss the indications, contraindications, limitations and potential complications, and interpret, discuss and report on results of the following:

a) Diagnostic
   • Arthography without or with CT/MRI (large/small joint)
   • Biopsy – percutaneous including tumour, lymph nodes and bone
   • Lumbar puncture
   • Myelography without or with CT
   • Cerebral and peripheral angiography – catheter (aortoliiac, coeliac (hepatic/splenic) and mesenteric studies, renal, lumbar).

b) Therapeutic
   • Intussusception reduction
   • Biliary intervention – PTC and drainage
   • Drainage catheter placement – percutaneous, abscess drainage
   • Radiologically inserted nasogastric tube, nasojejunal, naso-duodenal tube, gastrostomy or jejunostomy
   • Visceral stricture dilatation and stenting
   • Nephrostomy
   • Antegrade ureteric stent insertion
   • Dialysis related interventions – peritoneal dialysis catheters and central venous lines
   • Central venous catheter placement
   • Percutaneous vascular malformation/tumour management – venolymphatic, cystic hygroma – sclerosants
   • Other percutaneous pharmaceutical Interventions – bursal (particular subacromial), large synovial joint, synovial sheaths, regional blocks (e.g. carpel tunnel)
   • Endovascular or percutaneous embolisation - hyper-vascular tumour, vascular malformation, epistaxis
   • Radiofrequency ablation (RF/RFA)
   • Aneurysm repair – intracranial, aortic or peripheral artery.
Appendix 1
CLINICAL RADIOLOGY
CONDITIONS LISTINGS
LEARNING OUTCOMES: CLINICAL RADIOLOGY
CONDITION LISTINGS

The 2020/2021 revision of the Clinical Radiology Condition Listings is redesigned to both assist trainees in their learning and guide their assessment by supervisors and examiners. The aim is to consolidate and group as many conditions as possible to allow efficient and streamlined learning, limiting duplication as much as possible and clearly defining expectations. Rare or uncommon subtypes of common conditions have been listed as much as possible with their “parent” condition and this is itemised indicating that “knowing of” these rarer subtypes is only required.

As previous, the conditions in each body system have been divided into categories one, two or three in accordance with their commonality and diagnostic importance. A single document now demonstrates assignment to the general (GEN), pathology (PATH), paediatric (PAED) and key condition (KC) lists. There is now a spine condition category, which has amalgamated conditions previously listed in the neurological and musculoskeletal curricula. There is also a new genetic syndrome and multi-system conditions list for those that feature in a number of body systems. The purpose of this is to aid in a more holistic learning approach to these entities. Each of these have mostly been removed from each of the body system lists. It should be noted that the conditions lists are not intended to represent differential diagnosis checklists.

A comprehensive understanding of the pathology is expected for those assigned to the pathology curriculum and an in depth pathological knowledge is not expected for category 3 conditions. Section J is also a new feature and provides a list of selected neoplastic conditions where it is essential to have an in depth understanding and knowledge of their staging systems.

The condition listings will be reviewed, and revised if need be, on an annual basis to accommodate for changes in nomenclature and classification etc. Any ongoing feedback from Fellows and trainees would be welcomed by the Clinical Radiology Curriculum and Assessment Committee.

### A. GENETIC SYNDROMES / MULTI-SYSTEM CONDITIONS

**CARCINOGENIC MUTATIONS**

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<tr>
<th>Category 1</th>
<th>GEN</th>
<th>PATH</th>
<th>PAED</th>
<th>KC Category 2</th>
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<th>Category 3</th>
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<td>BREast CAncer (BRCA) 1 and 2</td>
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<td>Li-Fraumeni syndrome</td>
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<td>Succinate Dehydrogenase complex subunit D (SDHD)</td>
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**CONDITION ASSOCIATIONS**

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<tr>
<td>CHARGE syndrome (Coloboma, Heart defects, nasal choanae Atresia, Retardation of growth and/or development, Genital and/or urinary abnormalities, and Ear abnormalities and deafness)</td>
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<td>Kippel-Trenaunay-Weber syndrome</td>
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<td>CREST syndrome (Calcinoïd, Raynaud's phenomenon, Esophageal dysmotility, Sclerodactyly and Telangiectasia)</td>
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<td>PHACE syndrome (Posterior fossa – brain malformations, Hemangiomata, Arterial lesions, Cardiac abnormalities/aortic coarctation, Eye abnormalities)</td>
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<td>OECTHS syndrome (Vertebral defects, Anal atresia, Cardiac defects, Tracheo-esophageal fistula, Renal anomalies, and Limb abnormalities)</td>
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**CONGENITAL CONDITIONS**

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<tr>
<td>Heterotaxy and cardiopulmonary syndromes including dextrocardia situs inversus</td>
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**CONNECTIVE TISSUE DISORDERS**

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## GENETIC CONDITIONS

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## HAEMATOLOGICAL CONDITIONS

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<td>Plasmacytoma, multiple myeloma and other myeloproliferative disorders including myelofibrosis, Polycythaemia vera, light chain cast nephropathy and knowing of POEMS (Polyneuropathy, Organomegaly, Endocrinopathy, M protein and Skin) syndrome</td>
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## INFECTION/INFLAMMATORY CONDITIONS

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## METABOLIC CONDITIONS

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## NEOPLASTIC CONDITIONS

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## NEUROCUTANEOUS DISORDERS (PHAKOMATOSES)

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### Neurofibromatosis 2

### Sturge-Weber syndrome

### Tuberculous sclerosis complex including Subependymal Giant Cell Astrocytoma (SEGA)

### POLYPOSIS SYNDROMES

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### VASCULAR CONDITIONS AND VASCULITIDES

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### B. BRAIN CONDITIONS

#### GENERAL AND CLINICAL CONDITIONS

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### CYSTIC LESIONS

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### TRAUMA

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<td>Vascular injury (stroke/piercing)</td>
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<td>Non-Accidental Injury (NAI) / abusive head trauma</td>
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### Cerebrovascular

**Category 1** | GEN | PATH | PAED | KC | Category 2 | GEN | PATH | PAED | Category 3 | GEN | PAED
---|---|---|---|---|---|---|---|---|---|---|---
Global hypoxia, ischaemia and infarction | | | | | Intracranial aneurysms (vascular, pseudo/ blood blister extrinsic| | | | | | | | |
Neonatal encephalopathy including Hypoxic Ischaemic (HIE) | | | | | Cerebral Venous Sinus Thrombosis (CVST) | | | | | | | | |
Germinoma matrix haemorrhage | | | | | Arteriovenous malformation | | | | | | | | |
Periventricular leukomalacia | | | | | Dural arachnoiditis including Cranial - Cerebral sinus Fibula (CCF) | | | | | | | | |
Acute venous thrombosis, occlusion with an associated stroke syndrome | | | | | Vein of Galen malformation | | | | | | | | |
Lacunar infarct | | | | | Reversible Cerebral Vasoconstriction Syndrome (RCVS) | | | | | | | | |
Atherosomatic carotid stenosis | | | | | Vasculitis/kinking (primary/ secondary) | | | | | | | | |
Cerebrovascular atherosomatic disease | | | | | Cerebral amyloid angiopathy | | | | | | | | |
Chronic cerebrovascular insufficiency | | | | | Occlusive vasculopathies including Moyamoya | | | | | | | | |
Carotid and vertebral artery dissection | | | | | Focal cerebral arteriovenous | | | | | | | | |
Aneurysmal subarachnoid haemorrhage | | | | | Neurovascular conflict (e.g. trigeminal neuralgia, hemifacial spasm) | | | | | | | | |
Subarachnoid haemorrhage and related complications e.g. vasospasm | | | | | Developmental venous anomaly | | | | | | | | |
Perimesencephalic haemorrhage | | | | | Sturge Weber syndrome | | | | | | | | |
Intracerebral haemorrhage (traumatic and non-traumatic) | | | | | | | | | | | | |
Hypertensive microangiopathy | | | | | | | | | | | | |
Micro-haemorrhage | | | | | | | | | | | | |
Bleeder cerebrovascular infarction | | | | | | | | | | | | |
Diffuse atheros/thrombotic injury | | | | | | | | | | | | |
Intravascular venous thrombosis including venous sinus thrombosis and associated haemorrhage and/or venous infarction | | | | | | | | | | | | |

### Infectious/Inflammation

**Category 1** | GEN | PATH | PAED | KC | Category 2 | GEN | PATH | PAED | Category 3 | GEN | PAED
---|---|---|---|---|---|---|---|---|---|---|---
Acute meningitis – bacterial/aesptic | | | | | Congenital infection - TORCH | | | | | | | | |
Encephalitis / cerebritis / meningoencephalitis | | | | | Neurocysticercosis | | | | | | | | |
Brain abscess | | | | | Toxoplasmosis | | | | | | | | |
Ventriculitis | | | | | Cytomegalovirus | | | | | | | | |
Subdural empyema | | | | | | | | | | | | |
Extradural abscess | | | | | | | | | | | | |
Herpes simplex virus infection | | | | | | | | | | | | |
Autoimmune encephalitis e.g. anti- myelin oligodendrocyte glycoprotein (anti-MOG) syndromes, anti-AENA receptor encephalitis | | | | | | | | | | | | |

### Demyelinating

**Category 1** | GEN | PATH | PAED | KC | Category 2 | GEN | PATH | PAED | Category 3 | GEN | PAED
---|---|---|---|---|---|---|---|---|---|---|---
Multiple sclerosis | | | | | | | | | | | | |
Neuromyelitis Optica (NMO) | | | | | | | | | | | | |
Acute Disseminated Encephalomyelitis (ADEM) | | | | | | | | | | | | |
Tumefactive and variant demyelinating conditions | | | | | | | | | | | | |

### Neurodegenerative

**Category 1** | GEN | PATH | PAED | KC | Category 2 | GEN | PATH | PAED | Category 3 | GEN | PAED
---|---|---|---|---|---|---|---|---|---|---|---
Vascular dementias | | | | | Alzheimer disease | | | | | | | | |
Frontotemporal lobar degeneration | | | | | Amyotrophic Lateral Sclerosis (ALS) | | | | | | | | |
Parkinson disease | | | | | Dementia with Lewy bodies | | | | | | | | |
Multiple System Atrophy (MSA) | | | | | Progressive Supranuclear Palsy (PSP) | | | | | | | | |
Huntington disease | | | | | | | | | | | | |

### Toxic and Metabolic

**Category 1** | GEN | PATH | PAED | KC | Category 2 | GEN | PATH | PAED | Category 3 | GEN | PAED
---|---|---|---|---|---|---|---|---|---|---|---
Posterior Reversible Encephalopathy Syndrome (PRES) including acute hypertensive encephalopathy | | | | | Hypoglycaemia including neonatal hypoglycaemic encephalopathy | | | | | | | | |
Oxidative demyelination | | | | | | | | | | | | |
Status epilepticus | | | | | | | | | | | | |
Carbon monoxide poisoning | | | | | | | | | | | | |
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<td>© The Royal Australian and New Zealand College of Radiologists</td>
<td>September 2021</td>
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<td>Diffuse astrocytic and oligodendroglial tumours (including differing IDH status i.e. mutant vs wild-type) - diffuse astrocytoma, anaplastic astrocytoma, glioblastoma, oligodendroglioma, optic pathway glioma</td>
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<td>Metastases including atypical and anaplastic (malignant) subtypes</td>
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<td>Primary central nervous system including intravascular subtype</td>
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<td>Attention deficit disorders</td>
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Squamous cell carcinoma
Fibrous dysplasia
Osteosarcoma
Sino nasal undifferentiated carcinoma
Adenoacanthoma
Olfactory neuroblastoma
Ewing's sarcoma
Metastasis

**ORAL CAVITY; FLOOR OF MOUTH; SUBLINGUAL SPACE; ORAL AND HYPOPHARYNX; LARYNX; TRACHEA**

**SALIVARY GLANDS AND ASSOCIATED DUCTS**

**DENTAL; MAXILLOFACIAL**

**EAR AND TEMPORAL BONE including CEREBELLOPONTINE ANGLE AND BASE OF SKULL**

**NECK; SKIN, SOFT TISSUE AND LYMPH NODES**
<table>
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<th>Category 1</th>
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<td>Thyroid agenesis</td>
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<td>Lingual thyroid</td>
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<tr>
<td>Viral pneumonia including influenza, CMV, SARS-CoV-2 and other severe acute respiratory syndromes</td>
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<tr>
<td>Mycobacterium pneumonia (excluding tuberculosis and non-tuberculous infections)</td>
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<tr>
<td>Fungal infections including aspergillus, cryptococcosis, pneumonia cryptova, histoplasmosis and coccidioidomycosis</td>
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<td>Mycoplasma pneumonia</td>
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<tr>
<td>Lung abscess</td>
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<td>Meconium aspiration</td>
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**DIFFUSE LUNG DISEASE**

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<th>GEN PAED</th>
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</thead>
<tbody>
<tr>
<td>Pulmonary oedema</td>
<td>🌟 ✩ ✩ ✩</td>
<td>Eosinophilic alveolitis, hypersensitivity pneumonitis</td>
<td>✩ ✩ ✩ ✩</td>
<td>Lympnod interstitial pneumonia</td>
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</tr>
<tr>
<td>Acute Respiratory Distress Syndrome (ARDS)</td>
<td>🌟 ✩ ✩ ✩</td>
<td>Lymphangioleiomyomatosis</td>
<td>✩ ✩ ✩ ✩</td>
<td>Pneumopericardial fibrosis (PPFE)</td>
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<tr>
<td>Usual interstitial pneumonia pattern of lung disease including primary and secondary</td>
<td>🌟 ✩ ✩</td>
<td>Respiratory Bronchiolitis Interstitial Lung Disease (RBILD)</td>
<td>✩ ✩ ✩</td>
<td>Pulmonary Alveolar Microthiasis (PAM)</td>
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<tr>
<td>Idiopathic Pulmonary Fibrosis (IPF)</td>
<td>🌟 ✩ ✩</td>
<td>Desquamative Interstitial Pneumonia (DIP)</td>
<td>✩ ✩ ✩</td>
<td>Metastatic pulmonary calcification</td>
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<td>Non-Specific Interstitial Pneumonia (NSIP)</td>
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<td>Respiratory bronchiolitis-associated interstitial lung disease</td>
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<td>Acute Interstitial Pneumonia (AIP)</td>
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<td>Lipid pneumonia</td>
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<tr>
<td>Organising pneumonia including primary and secondary</td>
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<td>Alveolar proteinosis (pulmonary alveolar proteinosis)</td>
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<tr>
<td>Diffuse pulmonary haemorrhage</td>
<td>🌟 ✩ ✩</td>
<td>Pulmonary eosinophilia syndromes including simple eosinophilic pneumonia, eosinophilic granulomatosis and polymyalgia (Rheu. - Strauss syndrome), allergic bronchopulmonary aspergilliosis and drug-induced eosinophilic pneumonia</td>
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**TOXIC CONDITIONS**

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<tbody>
<tr>
<td>Pulmonary fibrosis associated with smoking</td>
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<td>Silo-filler's disease</td>
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<td>Silicosis including stone worker’s lung disease</td>
<td>🌟 ✩ ✩ ✩</td>
<td>Berylliosis</td>
<td>✩ ✩ ✩</td>
<td>Hard metal pneumoconiosis</td>
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<tr>
<td>Coal worker pneumoconiosis</td>
<td>🌟 ✩ ✩</td>
<td>Pulmonary radiation injury</td>
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<tr>
<td>Asbestos-related pleural disease including pleural plaques, mesothelioma and asbestos</td>
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<td>Drug-related lung damage including amiodarone toxicity</td>
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**VASCULAR PULMONARY CONDITIONS**

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</thead>
<tbody>
<tr>
<td>Pulmonary vascular congestion and oedema</td>
<td>🌟 ✩ ✩ ✩ ✩</td>
<td>Singer-James-Allen syndrome</td>
<td>✩ ✩ ✩</td>
<td>Hepatopulmonary syndrome</td>
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<tr>
<td>Pulmonary thrombosis and thromboembolism including acute and chronic</td>
<td>🌟 ✩ ✩ ✩</td>
<td>Goodpasture syndrome</td>
<td>✩ ✩ ✩</td>
<td>Pulmonary capillary haemangiomatisis</td>
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<tr>
<td>Pulmonary infarction</td>
<td>🌟 ✩ ✩ ✩</td>
<td>Septic emboli</td>
<td>✩ ✩ ✩</td>
<td>Diffuse pulmonary lymphangiomatisis</td>
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<tr>
<td>Pulmonary arterial hypertension including known of pulmonary venous-occlusive disease</td>
<td>🌟 ✩ ✩ ✩ ✩</td>
<td>Idiopathic pulmonary haemorrhage</td>
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<td></td>
<td></td>
<td>Pulmonary arteriovenous malformation</td>
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**AIRWAY AND PULMONARY NEOPLASTIC CONDITIONS**

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<tbody>
<tr>
<td>Solitary pulmonary nodule</td>
<td>🌟 ✩ ✩</td>
<td>Hamartoma</td>
<td>✩ ✩ ✩</td>
<td>Tracheobronchial papillomatosis</td>
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<tr>
<td>Squamous cell carcinoma</td>
<td>🌟 ✩ ✩ ✩</td>
<td>Peribronchial blastoma</td>
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<tr>
<td>Adenocarcinoma including adenocarcinoma in situ and minimally invasive adenocarcinoma</td>
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<tr>
<td>Small cell carcinoma</td>
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<tr>
<td>Large cell carcinoma</td>
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<td>Bronchial carcinoid</td>
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<tr>
<td>Neuroendocrine carcinoma</td>
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<td>Lymphangitis carcinomatosa</td>
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**PLEURAL, DIAPHRAGM AND CHEST WALL CONDITIONS EXCLUDING TRAUMA**

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<tbody>
<tr>
<td>Pectus deformity</td>
<td>🌟 ✩ ✩</td>
<td>Diaphragmatic hernia including Bochdalek, Morgagni, and congenital</td>
<td>✩ ✩ ✩</td>
<td>Sprengel deformity</td>
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<td>Kypochondrolisis</td>
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<tr>
<td>Pleural effusion including transudative, exudative and malignant</td>
<td>🌟 ✩ ✩ ✩</td>
<td>Bronchopulmonary fistula</td>
<td>✩ ✩ ✩</td>
<td>Solitary fibrous tumour</td>
<td>✩ ✩</td>
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<tr>
<td>Chylothorax</td>
<td>🌟 ✩ ✩</td>
<td>Diaphragmatic paralysis</td>
<td>✩ ✩ ✩</td>
<td>Sarcoidosis</td>
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<tr>
<td>Thoracic empyema</td>
<td>🌟 ✩ ✩</td>
<td>Chest wall infection</td>
<td>✩ ✩ ✩</td>
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<tr>
<td>Pleural fluid and lymphosor</td>
<td>🌟 ✩ ✩</td>
<td>Elastic bronchial and thrombotosis</td>
<td>✩ ✩ ✩</td>
<td>Chondroid tumours including chondrosarcoma</td>
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**HEART AND PERICARDIAL CONDITIONS**

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<th>GEN PAED</th>
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<tbody>
<tr>
<td>Cardiac failure (left and right)</td>
<td>🌟 ✩ ✩ ✩ ✩</td>
<td>Left to right shunt including atrial septal defect, ventricular septal defect and patent ductus arteriosus</td>
<td>✩ ✩ ✩</td>
<td>Takotsubo cardiomyopathy (Broken heart syndrome)</td>
<td>✩ ✩</td>
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<tr>
<td>Myocardial infarction</td>
<td>🌟 ✩ ✩ ✩</td>
<td>Right heart malformations including Eosinin, Truncus and pulmonary value anomalies (stenosis and atresia)</td>
<td>✩ ✩ ✩</td>
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<tr>
<td>Hypertensive heart disease</td>
<td>🌟 ✩ ✩ ✩</td>
<td>Left heart malformations including hypoelastic left heart, bicuspid aortic valve, aortic stenosis and total anomalous pulmonary venous drainage</td>
<td>✩ ✩ ✩</td>
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<tr>
<td>Aortic stenosis</td>
<td>🌟 ✩ ✩ ✩</td>
<td>Congenital malformations including tetralogy of Fallot, transposition of the great arteries, bicuspid aortic valve and double outlet right ventricle</td>
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<td>Gastric volvulus</td>
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<td>Diverticulitis of the colon</td>
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<td>Ectopic parathyroid glands</td>
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<td>Germ cell tumours including teratoma and seminoma</td>
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<td><strong>Iatrogenic Conditions</strong></td>
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<td>Endotracheal, intercostal tube, chest drainage tube and catheter assessment</td>
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<td>Pacemaker wire position and malposition complications</td>
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<td>In vivo line position and malposition including central lines</td>
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<tr>
<td>Pulmonary oedema and fluid overload</td>
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<tr>
<td>Pulmonary interstitial emphysema</td>
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<td>Complications of prostatic valves</td>
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<td>Oesophageal atresia</td>
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<td>Tracheo-oesophageal fistula</td>
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<td>Oesophageal obstruction including stenoses, achalasia, web, ring and motility disorders</td>
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<td>Adenocarcinoma</td>
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<td>Seawater foreign bodies</td>
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<td><strong>Stomach</strong></td>
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<td>Gastritis including acute, chronic and caustic</td>
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<td>Hiatus hernia</td>
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**Clinical Radiology Learning Outcomes**

**Specialty Training Unit**

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September 2021

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### SMALL INTESTINE

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<td>Duodenal stenosis including webs</td>
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<td>Intestinal infections including bacterial, viral, fungal, parasitic and opportunistic organisms</td>
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### LARGE INTESTINE

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<td>Infectious colitis including typhilitis and tuberculosis</td>
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<td>Hirschsprung disease</td>
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<td>Radiation colitis</td>
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<td>Large bowel obstruction</td>
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<td>Colonic duplication</td>
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<td>Necrotizing enterocolitis</td>
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<td>Volvulus including caecal and sigmoid</td>
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<td>Rectal prolapse, ulcer and intussusception</td>
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<td>Meconium plug syndrome / small left colon</td>
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<td>Colonic ischaemia</td>
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<td>Celiac ileus and acute colonic pseudo-obstruction (Ogilvie syndrome)</td>
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<td>Intestinal ischaemia including ischaemic colitis</td>
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<td>Large intestinal trauma</td>
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<td>Diverticular disease and complications including diverticulitis</td>
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### APPENDIX

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<td>Neuroneuroendocrine Tumour (NET)</td>
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<td>Neuroneuroendocrine Tumour (NET)</td>
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<td>Appendicitis</td>
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### ANUS

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<td>Squamous cell carcinoma</td>
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### LIVER, GALLBLADDER AND BILE DUCTS

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<th>PAED</th>
<th>Category 3</th>
<th>GEN</th>
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<td>Congenital abnormalities of the biliary system including atresia, gall bladder aplasia / hypoplasia and bile duct variants</td>
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<td>Fibrolipocytic liver disease including congenital hepatic fibrosis, biliverdin, bilirubin, biliverdine, bilirubin-kinase, and biliverdin reductase</td>
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<td>Fibrolipocytic liver disease including congenital hepatic fibrosis, biliverdin, bilirubin, biliverdine, bilirubin-kinase, and biliverdin reductase</td>
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<td>Hepatitis including viral, autoimmune, drug related, alcoholic and neonatal</td>
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<td>☒</td>
<td>Hydral disease</td>
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<td>Cholangiohepatitis including Mirizzi syndrome</td>
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<td>Acute hepatitis including pyogenic, tuberculous, fungal and amoebic</td>
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<td>Acute hepatitis including pyogenic, tuberculous, fungal and amoebic</td>
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<td>Cholangitis including acute, subacute and chronic</td>
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<td>Infectious cholangiopathies</td>
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<td>Hepatic failure including acute and chronic</td>
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<td>Vascular malformation including arterio-portal shunts</td>
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<td>Pancreatitis including acute and chronic inflammation pseudocysts and other complications, including knowledge of groove and autoimmune pancreatitis</td>
<td>Pancreas divisum</td>
<td>Congenital anomalies including agenesis, cystic pancreatic tissue and asymmetric constitution</td>
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<td>Pancreatic lipomatous pseudohyperplasia</td>
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<td>Non-neoplastic cysts</td>
<td>Acinar cell carcinoma</td>
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<td>Intraductal papillary mucinous neoplasm of the pancreas</td>
<td>Pancreaticoblastoma</td>
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<td>Neurinoma Tumour (NET)</td>
<td>Ampulla of Vater adenocarcinoma</td>
<td>Post-surgical appearances and complications including transplantation</td>
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**KIDNEY AND UPPER URINARY TRACT**

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<td>Renal lymphangiomatosis</td>
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<td>Thrombotic microangiopathies including hemolytic uremic syndrome and thrombotic thrombocytopenic purpura</td>
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<td>Glomerulonephritis</td>
<td>Paroxysmal nocturnal haemoglobinuria</td>
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<td>Acute tubular injury/hemorrhage</td>
<td>Nephrosclerosis</td>
<td>Urate nephropathy</td>
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<td>Diffuse (acute) cortical necrosis</td>
<td>Atrophic interstitial fibrosis including atrophic</td>
<td>Analgesic nephropathy</td>
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<td>Renal papillary necrosis</td>
<td>Renal artery stenosis including florid-mucosal dysplasia</td>
<td>Lithium nephropathy</td>
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<td>Pyelonephritis including acute and chronic, sacthrogenocystic and emphysematous pyelonephritis</td>
<td>Renal artery aneurysm</td>
<td>Renal lipomatosis</td>
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<td>Renal abscess and pyonephrosis</td>
<td>Renal vein thrombosis</td>
<td>Metabolic adenoma</td>
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<td>Renal trauma including renal vascular injury and urine</td>
<td>Medullary sponge kidney</td>
<td>Mixed epithelial and stromal tumour</td>
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<td>Renal infect</td>
<td>Autosomal recessive (childhood) poly cystic kidney disease</td>
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<td>Unilateral and nephrocalcinosis</td>
<td>Multilocular cystic nephroma</td>
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<td>Simple renal cysts including parapelvic and parapelvic</td>
<td>Oncocytoma</td>
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<td>Autosomal dominant (adult) poly cystic kidney disease</td>
<td>Angiomyolipoma</td>
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<td>Acquired (dialysis-associated) cystic disease</td>
<td>Mesangiocapillary</td>
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**LOWER URINARY TRACT INCLUDING THE PENIS**

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<td>Bladder endometriosis</td>
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<td>Hydroureter</td>
<td>ureter, ureterocele, primary mega ureter, ureteral diverticula, bladder exophyto, and urachal anomalies</td>
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<tr>
<td>Posterior urethral valves</td>
<td>Fistulae associated with inflammatory bowel disease</td>
<td>Nephrogenic adenoma</td>
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</table>
Vesico-urethral reflux
Inflammatory pseudotumor (pseudosarcomatous fibrosarcoma tumor)
Leiomyomas
Vesico-urethral junction obstruction
Hydronephrosis
Upper tract urothelial carcinoma
Bladder cancer
Cystitis including knowing of cystitis cystica, cystitis glandulosa and eosinophilic cystitis
Squamous cell carcinoma
Squamous cell carcinoma of the penis
Urethra
Adenocarcinoma
Retro pelvic collecting system trauma
Post- treatment/surgical appearances and complications including radiotherapy and chemotherapy cysts
Urethral stricture and diverticulum
Peysors disease
Urethral and bladder calculus
Neurogenic bladder
Bladder diverticulum
Urethral (transitional cell) carcinoma

SCROTUM, TESTIS AND EPIDIDYMIS
Category 1
GEN PATH PAED KC Category 2
GEN PATH PAED Category 3
GEN PAED
Cryptorchidism
Pyocoele
Spermatocele
Epidermoid cyst
Orchitis
Hydrocoele
Varicocele
Adenomatoid tumour
Scoliosis/torsion trauma including haematocele
Spermatic cord injury and segmental infarction
Mesenteric panniculitis
Germ cell tumours including seminoma and non-seminoma including teratoma, yolk sac tumour, embryonal carcinoma, choriocarcinoma
Spermatocytic tumour
Sex cord-gonadal stromal tumours

PROSTATE AND SEMINAL VESICLE
Category 1
GEN PATH PAED KC Category 2
GEN PATH PAED Category 3
GEN PAED
Prostatitis
Prostatic abscess
Prostate cyst
Benign prostatic (nodular) hyperplasia
Prostatitis
Inferior vena cava anomalies including (ACLs) (mesenteric cystic lymphangioma)

ADRENAL GLAND
Category 1
GEN PATH PAED KC Category 2
GEN PATH PAED Category 3
GEN PAED
Adrenal trauma
Secondary adrenal hyperplasia
Congenital adrenal hyperplasia (adrenogenital syndrome)
Non traumatic adrenal haemorrhage including Waterhouse-Friderichsen syndrome
Myelolipoma
Fungal infection
Hyperparasisis (Cushing syndrome)
Addison disease
Primary hyperaldosteronism (Conn syndrome)
Adrenal cortical insufficiency
Adrenal adenoma
Adrenal carcinoma
Pheochromocytoma

SPLEEN
Category 1
GEN PATH PAED KC Category 2
GEN PATH PAED Category 3
GEN PAED
Splenomegaly
Aspergillosis/splenomegaly
Splenomegaly and hypersplenism
Splenectomy and abscesses
Splenectomy and delayed
Spleenic cyst
Haemangioscarcoma

PERITONEUM / MESENTERY INCLUDING ABDOMINAL WALL AND CAVITY
Category 1
GEN PATH PAED KC Category 2
GEN PATH PAED Category 3
GEN PAED
Asciplasia
Epiploic appendages
Spleenic appendicitis
Trauma including mesenteric injury, haemoperitoneum and diaphragmatic rupture
Mesenteric panniculitis
Splenectomy
Pneumoperitoneum
Post operative appearances and complications
Mesenteric adenitis
Post operative appearances and complications
Intrabdominal abscesses
Segmental arterial mediodysplasia
Ileostomy
Internal hernia including paraduodenal, transmesenteric, postoperative, Bochdalek and Morgagni
External hernia including inguinal, femoral, obturator, ventral, Spigelian, lumbar, umbilical and traumatic abdominal wall
Pseudomyxoma peritoneum

RETROPERITONEUM
Category 1
GEN PATH PAED KC Category 2
GEN PATH PAED Category 3
GEN PAED
Retroperitoneal trauma
Inferior vena cava anomalies including duplications
Arteriovenous fistula
### Aortic atherosclerosis, aneurysm, pseudoaneurysm, dissection and rupture
- Retropertioneal fibrosis
- Segmental arterial medial thickening

### Retroperitoneal fibrosis
- Segmental arterial mediolysis

### Aorto-iliac occlusion
- Coeliac artery, Superior Mesenteric Artery (SMA), or Inferior Mesenteric Artery (IMA) compression syndromes (intestinal angina)
- Pelvic lipomatosis

### Pelvic lipomatosis
- Aortoenteric fistula

### Aortoenteric fistula
- Peripheral nerve sheath tumour including the malignant subtype
- Germ cell tumour including teratoma

### Inferior vena cava obstruction including knowing of May–Thurner Syndrome (MTS)
- Retroperitoneal sarcoma including knowing of leiomyosarcoma, liposarcoma, Ewing sarcoma, synovial sarcoma and haemangiopericytoma
- Post-treatment appearances and complications including haemorrhage, aortic endoleak and lymphocoele development

### G. MUSCULOSKELETAL CONDITIONS
#### CONGENITAL AND DEVELOPMENTAL CONDITIONS

<table>
<thead>
<tr>
<th>Category 1 GEN PATH PAED KC</th>
<th>Category 2 GEN PATH PAED</th>
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<td>Achondroplasia ✯ ✯ ✯</td>
<td>Achondrogenesis ✯ ✯</td>
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<td>Arthrogryposis ✯</td>
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<td>Asphyxiating thoracic dystrophy (Jeune syndrome) ✯</td>
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<td>Feng Disease (Nail-Patella syndrome) ✯ ✯</td>
<td>Chromodentocristal dysplasia (Ellis-van Creveld) ✯</td>
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<td>Hydropspheroptasia ✯</td>
<td>Congenital Pseudarthrosis of the Tibia (CPT) ✯</td>
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<tr>
<td>Melorheostosis ✯</td>
<td>Muscular dystrophy ✯ ✯</td>
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<tr>
<td>Other disease ✯</td>
<td>Dysplasia Epiphysialis Hemimelia (DEH) ✯</td>
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<td>Osteogenesis imperfecta ✯ ✯</td>
<td>Intramembranous osteosclerosis ✯</td>
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<td>Osteoporosis ✯</td>
<td>Mastocytosis ✯</td>
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<td>Osteopetrosis ✯ ✯</td>
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<td>Pseudarthrodysplasia ✯</td>
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<td>Pyknodysostosis ✯</td>
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<td>Osteopoikilosis ✯ ✯</td>
<td>Spondyloepiphyseal dysplasia congenita ✯</td>
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<tr>
<td>Pseudoachondroplasia ✯ ✯</td>
<td>Trapezospinal dwarfism ✯</td>
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### TRAUMA

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<td>Bone bruising ✯ ✯ ✯</td>
<td>Osteochondral defect ✯ ✯</td>
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<tr>
<td>Fracture including greenstick, bowing, Salter-Harris, buckle, torus, pathological, delayed union and non-union with assessment of stability ✯ ✯</td>
<td>Stress reaction and insufficiency fracture ✯</td>
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<td>Avulsion injury including epiphyseal, apophyseal, and physeal injuries ✯</td>
<td>Maffet-Lavelle lesion ✯</td>
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<tr>
<td>Muscle and tendon tear and rupture ✯</td>
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<tr>
<td>Ligamentous injury including assessment of stability ✯</td>
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<td>Subluxation and dislocation including assessment of instability ✯</td>
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<tr>
<td>Fracture - dislocation including Monteggia, Galeazzi, Lisfranc injuries with assessment of stability ✯ ✯</td>
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<tr>
<td>Joint effusion ✯</td>
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<td>Lipohaemarthrosis ✯ ✯</td>
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<tr>
<td>Non-accidental injury ✯ ✯</td>
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<tr>
<td>Haematoma ✯</td>
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<tr>
<td>Foreign bodies ✯</td>
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### VASCULAR AND HAEMATOLOGICAL CONDITIONS

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</thead>
<tbody>
<tr>
<td>Increased bone marrow cellularity ✯</td>
<td>Klippel-Trenaunay-Weber (KTW) syndrome ✯</td>
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<tr>
<td>Diffuse and foci bone marrow infiltration replacement ✯</td>
<td>Primary lymphoma of bone ✯</td>
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<tr>
<td>Bone marrow fibrosis ✯</td>
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<tr>
<td>Avascular necrosis ✯</td>
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<tr>
<td>Bone infarct ✯ ✯ ✯</td>
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### INFECTIONS / INFLAMMATION

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</thead>
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<tr>
<td>Osteomyelitis including acute and chronic ✯</td>
<td>Congenital infection including rubella and syphilis ✯ ✯</td>
<td>Brucellosis ✯</td>
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<tr>
<td>Bursitis ✯</td>
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<td>Leprosy ✯</td>
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<td>Tendovaginitis ✯</td>
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<td>Polio ✯</td>
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<tr>
<td>Neurocutaneous fascitis ✯</td>
<td>Fungal infections including Mucor infection ✯</td>
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<tr>
<td>Infectious arthritis including supplicative (septic) ✯ ✯</td>
<td>Rickettsial infections and related infections including Lyme disease and Rocky Mountain spotted fever ✯</td>
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### NON-INFECTIVE SPONDYLOARTHRITIDES AND INFLAMMATORY CONDITIONS

<table>
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</thead>
<tbody>
<tr>
<td>Rheumatoid arthritis including rheumatoid nodules ✯</td>
<td>Enteritis associated arthritis ✯</td>
<td>Felty syndrome ✯</td>
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</tbody>
</table>
### DEGENERATIVE CONDITIONS

**Category 1**

- Osteoarthritis of the knee
- Osteoarthritis of the hip
- Osteoarthritis of the spine
- Osteoarthritis (OA) of the hand

**Category 2**

- Osteoarthritis of the ankle
- Osteoarthritis of the shoulder
- Osteoarthritis of the elbow

**Category 3**

- Osteoarthritis of the wrist
- Osteoarthritis of the foot

### SPECIFIC UPPER LIMB CONDITIONS

**Category 1**

- Glenohumeral dislocations
- Shoulder instability including labral lesions including Bankart, Anterior Labroligamentous Periosteal Sleeve Avulsion (ALPSA), Glenolabral Articular Disruption (GLAD), Humeral Avulsion of the Glenohumeral Ligament (HALS), SLAP (Superior Labrum from Anterior to Posterior) tear and denervation syndromes

**Category 2**

- Shoulder impingement
- Neuropathic (Charcot) shoulder
- Hypertrophic hammer syndrome

**Category 3**

- Rotator cuff tendinopathy and tears
- Glenoid hypoplasia
- Parsonage-Turner syndrome

### SPECIFIC LOWER LIMB CONDITIONS

**Category 1**

- Lower limb joint instability including ankle sprain, anterior cruciate ligament (ACL) tear, posterior cruciate ligament (PCL) tear, and patellar ligament撕裂
- Patellar tendinopathy and tears
- Patellar tendinopathy (Jumper's knee)

**Category 2**

- Achilles tendinopathy and tears
- Achilles tendinopathy (Achilles tendinitis)
- Achilles tendinopathy (Calcaneal spur)

**Category 3**

- Hallux valgus
- Pes planus
- Pes cavus

### TOXIC / METABOLIC CONDITIONS

**Category 1**

- Calcium pyrophosphate crystal deposition (CPPD) disease
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**Category 2**

- Calcium pyrophosphate crystal deposition (CPPD) disease
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- Calcium pyrophosphate crystal deposition (CPPD) disease
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### TOXIC / METABOLIC CONDITIONS

**Category 1**

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### NEOPLASIA AND TUMOUR LIKE CONDITIONS OF BONE AND SOFT TISSUE

**Category 1**

- Rhabdomyosarcoma
- Rhabdomyosarcoma
- Rhabdomyosarcoma

**Category 2**

- Rhabdomyosarcoma
- Rhabdomyosarcoma
- Rhabdomyosarcoma

**Category 3**

- Rhabdomyosarcoma
- Rhabdomyosarcoma
- Rhabdomyosarcoma
### Clinical Radiology Learning Outcomes

**Specialty Training Unit**
© The Royal Australian and New Zealand College of Radiologists

September 2021

<table>
<thead>
<tr>
<th>Category</th>
<th>GEN</th>
<th>PATH</th>
<th>PAED</th>
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**SPECIFIC LOWER LIMB CONDITIONS**

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<td><strong>Acute osteonecrosis of the femur</strong></td>
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**BENIGN EPITHELIAL LESIONS**

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<tbody>
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<td><strong>Usual ductal hyperplasia</strong></td>
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**LOBULAR NEOPLASIA**

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<tbody>
<tr>
<td><strong>Atypical lobular hyperplasia</strong></td>
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<tr>
<td><strong>Invasive lobular carcinoma</strong></td>
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**INTRADUCTAL PROLIFERATIVE LESIONS**

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</table>
### Columnar cell lesions
- ✩ Atypical ductal hyperplasia
- ✩ Ductal carcinoma in situ

### Intraductal Papillary Lesions

<table>
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<tbody>
<tr>
<td>Introducatal papilloma, including large (central) and small duct (peripheral) lesions</td>
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### Epithelial Lesions

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<tr>
<td>Invasive breast carcinoma, no special type including Tumour Infiltrating Lymphocyte (TIL)-rich invasive breast carcinoma, no special type</td>
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### Mesenchymal Lesions

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<tbody>
<tr>
<td>Lipoma</td>
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### Fibroepithelial Lesions

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<tbody>
<tr>
<td>Fibroadenoma</td>
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### Other Malignant Tumours

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<td>Inflammatory carcinoma</td>
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### Miscellaneous

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<tr>
<td>Benign breast calcifications</td>
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### Obstetric and Gynaecology Conditions

#### Vulva, Vagina and Urethra

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<tr>
<td>Bartholin cyst and Bartholinitis</td>
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#### Uterine Cervix

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<td>Nabothisian cysts</td>
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#### Uterine Corpus

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<tr>
<td>Congenital uterine anomalies including hypoplasia/agenesis, unicornate and bicornuate uterus, uterus didelphys, septate uterus, arcuate uterus, congenital cysts</td>
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### Breast Implant Types and Complications

- ✩ Breast implant types and complications

### Scar

- ✩ Scar

### Lymphoedema

- ✩ Lymphoedema

### Cosmetic oil and gel injections

- ✩ Cosmetic oil and gel injections

### Seroma

- ✩ Seroma

### Reduction

- ✩ Reduction

### Haematoma

- ✩ Haematoma

### Post - Treatment / Procedure Changes

<table>
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<th>Category 1</th>
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### Bartholin duct cyst

- ✩ Bartholin duct cyst

### Mayer-Rokitansky-Küster-Hauser (MRKH) syndrome

- ✩ Mayer-Rokitansky-Küster-Hauser (MRKH) syndrome

### Vaginal atresia and septa

- ✩ Vaginal atresia and septa

### Urethral diverticulum

- ✩ Urethral diverticulum

### Vaginal fistula

- ✩ Vaginal fistula

### Yolk sac tumour

- ✩ Yolk sac tumour

### Carcinoma

- ✩ Carcinoma

### Extramammary Paget disease

- ✩ Extramammary Paget disease

### Inflammatory carcinoma

- ✩ Inflammatory carcinoma

### Sarcoma including post-radiation angiosarcoma

- ✩ Sarcoma including post-radiation angiosarcoma

### Lymphoma including breast implant-associated anaplastic large cell lymphoma

- ✩ Lymphoma including breast implant-associated anaplastic large cell lymphoma

### Fibroadenoma

- ✩ Fibroadenoma

### Phyllodes tumour

- ✩ Phyllodes tumour

### Hamartoma (fibroadenolipoma)

- ✩ Hamartoma (fibroadenolipoma)

### Uterine arteriovenous malformation

- ✩ Uterine arteriovenous malformation

### Endometrial hyperplasia including atypical

- ✩ Endometrial hyperplasia including atypical

### Pyomyoma

- ✩ Pyomyoma

### Uterine arteriovenous malformation

- ✩ Uterine arteriovenous malformation

### Leiomyosarcoma

- ✩ Leiomyosarcoma

### Malignant mixed mesodermal tumour

- ✩ Malignant mixed mesodermal tumour

### Endometrial stromal sarcoma

- ✩ Endometrial stromal sarcoma
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<td>Mature cystic teratoma (dermoid cyst)</td>
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<td>Anembryonic pregnancy (mucorarage)</td>
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<td>Encephalocoele including occipital, parietal, frontal and atracic</td>
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<td>Chiari malformations</td>
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<td>Malformations of cortical development including schizencephaly, lissencephaly, pachygyria, grey matter heterotopia and polymicrogyria</td>
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<td>Holoprosencephaly spectrum including atotor, septo-optic dysplasia and synptelopecephaly</td>
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<td>Aqueductal stenosis</td>
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<td>Ventriculomegaly including Vien of Galen malformation</td>
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<td>Congenital infection - TORCH (Toxoplasmosis, Rubella, Cytomegalovirus, Herpes Simplex Virus, Other)</td>
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<td>Neuroepithelial brain tumors (choroid plexus papilloma, medulloblastoma, astrocytoma)</td>
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<td>Neoplasms of the central nervous system (e.g. medulloblastoma, astrocytoma)</td>
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<td>Sequelae and chronic changes associated with brain injury including encephalomalacia and porencephaly</td>
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Specialty Training Unit
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September 2021

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Bronchopulmonary sequestration including intralobar and extralobar

Bronchogenic cyst

Pulmonary hypoplasia and agenesis

Congenital Pulmonary Airway Malformation (CPAM)

Heterolocry and cardiopulmonary syndromes including diastemacardia and situs inversus

Left to right shunt including atrial septal defect, ventricular septal defect and patent ductus arteriosus

Right heart malformations including lobar, tricuspid and pulmonary value anomalies (stenosis and atresia)

Left heart malformations including hypoplastic left heart, aortic coarctation/stenosis and total anomalous pulmonary venous drainage

Conotruncal malformations including Tetralogy of Fallot, transposition of the great arteries, tumors arterioles and double outlet right ventricle

Fetal arrhythmias

Cardiomyopathy including dilated, hypertrophic and restrictive

Rhabdomyoma

Lymphatic malformation

Germ cell tumours including mediastinal teratoma

Bronchopulmonary sequestration including intralobar and extralobar

Bronchogenic cyst

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Fetal arrhythmias

Cardiomyopathy including dilated, hypertrophic and restrictive

Rhabdomyoma

Lymphatic malformation

Germ cell tumours including mediastinal teratoma

Fetal abdomen (wall, gastrointestinal, genitourinary, hepato-biliary)

Category 1 GEN PATH PAED KC Category 2 GEN PATH PAED Category 3 GEN PAED

Omphalocoele

Anomalies including double/brifd/ ectopic ureter, ureteroceles, primary megaureter, ureteric diverticulum, bladder exstrophy and urachal anomalies

Body stalk anomaly

Gastrochisis

Bladder exstrophy

Clasical exstrophy including OBLS (Omphalocoele-clasical Exstrophy- Imperforate anus-Spinea) syndrome

Bowel atresia including duodenal, esophageal, small bowel, colonic and anal atresia

Enteric duplication cyst

Prune-belly syndrome

Volvulus

Lymphatic malformations including Abdominal Cystic Lymphangioma (ACL) (mesenteric-cystic (lymphangima)

Pentalogy of Cantrell

Meconium peritonitis, pseudocyst

Gallstones

Germ cell tumours including mediastinal teratoma

Hepatic haemangioma including congenital and haemangiomatosus

Choleochal cyst

Mesenchymal hamartoma

Hepatocellular adenoma

Non-traumatic adrenal haemorrhage

Hepatic mesenchymal lesions including inflammatory pseudotumor, fibroma, angiofibroma, angiomylipoma, epithelioid hemangioendotheloma, malignant fibrous histiocyte, fibromyxoma, and follicular dendritic cell sarcoma

Multicystic dysplastic kidney

Neuroblastoma

Congenital adrenal hyperplasia

Renal anomalies including agenesis, ectopic, horseshoe, duplex and crossed fused ectopic

Persistent right umbilical vein

Hydrocoelpos

Renal collecting system duplication

Ovarian cyst

Hepatoblastoma

Crosse fused ectopia

Urethral anomalies including patent urachus, urachal cyst, umbilical -urachal sinus and vesicourethral diverticulum

Hepatic mesenchymal lesions including inflammatory pseudotumor, fibroma, angiofibroma, angiomylipoma, epithelioid hemangioendotheloma, malignant fibrous histiocyte, fibromyxoma, and follicular dendritic cell sarcoma

Fetal renal collecting system dilatation

Bladder outlet obstruction / Lower Urinary Tract Obstruction (LUTO) including posterior urethral valves

Urimena

Autosomal recessive (childhood) polyuria renal disease

Mesodiblastic nephroma

Fetal musculoskeletal (dysplasias/malformations)

Category 1 GEN PATH PAED KC Category 2 GEN PATH PAED Category 3 GEN PAED

Talipes Equinovalis (TEV)

Achondroplasia

Akinsella-hypokinesia sequence including osteoarthritis

Polydactyly, syndactyly and clinidactyly

Osteogenesis imperfecta

Focal femoral deficiency

Achondrogenic, hyperchondrogenesis

Akoledogenesys

Proximal focal femoral dysplasia

Short-rb polydactyly syndrome

Spina bifida foot malformation

Proximal focal femoral dysplasia

Camptomelic dysplasia

Amelia, pheocromea and tal'aut development

Radial Ray syndrome

Spina bifida foot malformation

Thalassemic dysplasia

Chondrodrapasia punctata

Hydrophosphatasis

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PLACENTA AND UMBILICAL CORD

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<td>Placentomegaly</td>
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<td>Placental infection</td>
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<td>Placental haemorrhage and abruption</td>
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<td>Mortally Adherent Placenta including accreta, increta, and percreta</td>
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<td>Placental mesenchymal dysplasia</td>
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<td>Placental variations including succenturate lobes, circumvallate placenta and placenta reniformis</td>
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<td>Invasive mole</td>
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<td>Placental site trophoblastic tumour</td>
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CHROMOSOMAL DISORDERS (ANEUPLOIDY) [NB Listed also in Genetic Syndrome and Multi-system Conditions]

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MULTIPERUTER ordinal twins (TRAPS) | ☐ | ☐ | ☐ | ☐ | Dichorionic - diamniotic twins | ☐ | ☐ | ☐ | ☐ | Dichorionic - diamniotic twins | ☐ | ☐ |
| Monochorionic - monoamniotic twins | ☐ | ☐ | ☐ | ☐ | Monochorionic - monoamniotic twins | ☐ | ☐ | ☐ | ☐ | Monochorionic - monoamniotic twins | ☐ | ☐ |
| Discordant twin growth | ☐ | ☐ | ☐ | ☐ | Discordant twin growth | ☐ | ☐ | ☐ | ☐ | Discordant twin growth | ☐ | ☐ |

GESTATIONAL INFECTIONS

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FETAL WELL BEING ASSESSMENT

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J. STAGING SYSTEM AND CLASSIFICATION GUIDE

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