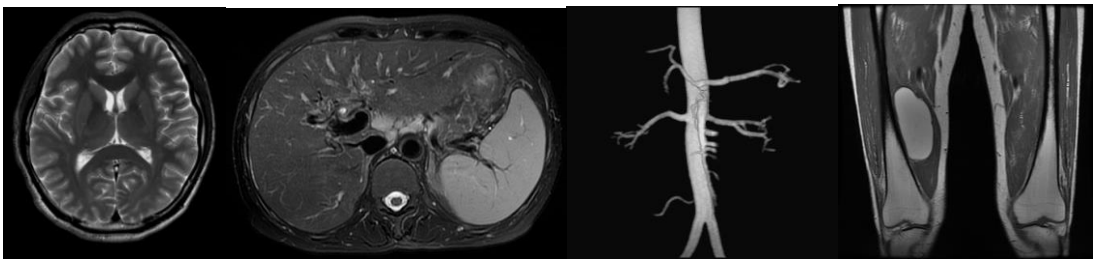
The Hong Kong College of Radiographers and Radiation Therapists

Certification Examination of Magnetic Resonance Imaging (MRI)



Objective

The objective of the Certification Examination of MRI is to provide an alternative channel for Radiographers who can attain the recognised standards in MR imaging to be admitted as a Member of the Hong Kong College of Radiographers and Radiation Therapists (HKCRRT) (Magnetic Resonance Imaging) MHKCRRT(MRI).

Entry Requirements

- Being a Radiographer registered with the Hong Kong Radiographers' Board
- 5 years of post-registration working experience in medical imaging
- A recognized Bachelor degree in medical imaging or related fields, or Professional Diploma in Diagnostic Radiography (PDDR) of the Hong Kong Polytechnic University, or equivalent

Format of Certification Examination

150 Multiple Choice Questions covering basic principles and clinical applications of MRI such as:

- MRI safety (10%)
- MRI physical principles (20%)
- Imaging pulse sequences (20%)
- MRI instrumentation (10%)
- Imaging artifacts (15%)
- MRI contrast media (5%)
- MRI anatomy & pathology (20%)

{Please refer to the section of syllabus of examination for details.}

Candidates can be admitted as a Member of the Hong Kong College of Radiographers and Radiation Therapists (HKCRRT) (Magnetic Resonance Imaging) MHKCRRT(MRI) if they have attained a grade of 75% or above in the certification examination **AND** achieved the requirements of MRI clinical experience as set by HKCRRT. A MRI Certificate will be issued by HKCRRT for those candidates who attained a grade of 75% or above in the certification examination.

{Please refer to the section of requirements of clinical experience for details}

Duration of Examination

3 hours

Schedule of Examination

14 November 2015 (Saturday) 2:30pm – 5:30pm

Examination Fee

$600

The first-year membership fee ($600) will be waived if the candidate can be admitted as a member of HKCRRT.

Syllabus of Examination

(A) MRI Safety

- Effect of static magnetic field
- Effect of time-varying gradient magnetic field
- Effect of radiofrequency field
- Magnetic and radiofrequency shielding
- Cryogen-related issues
- Safety concerns of MRI site planning
- Patient screening
- Basic emergency procedures

Sample question

Which is the measurement unit of Specific Absorption Rate (SAR)?

A. Joule per kilogram
B. Watt per kilogram
C. Volt per Tesla
D. Watt per Tesla

(B) MRI Physical Principles

- Nuclear Physics
- Relaxation mechanism
- Spatial encoding of MRI signals
- K-space sampling techniques
- Fourier transformation
- Image contrast mechanisms
- Image quality optimization
- Image compensation techniques – flow compensation, spatial saturation, spectral saturation, respiratory and cardiac gating / triggering, navigator echo, magnetization transfer pulse etc.

Sample question

T1 relaxation time is the measurement of time required for the longitudinal magnetization vector to recover what percentage of its maximum value after the application of a 90 degree radiofrequency pulse:

A. 33%
B. 37%
C. 63%
D. 67%

(C) Imaging Pulse Sequences

- MRI pulse sequence structure, design and imaging characteristics
- Concept of pulse sequence diagram
- Implications of changing pulse sequence parameters such as TR, TE, flip angle etc.
- Spin echo and fast spin echo imaging
- Gradient echo imaging
- Inversion recovery sequences
- Echo Planar Imaging (EPI)
- Diffusion-weighted imaging (DWI)
- Diffusion tensor imaging (DTI)
- Perfusion imaging
- Single- and multi-voxel MR spectroscopy
- Flow dependent MR angiography / venography
- Contrast-enhanced MR angiography / venography
- Time-resolved imaging of contrast kinetics
- Parallel imaging techniques

Sample question

Which of the following means can reduce T2 blurring effect of fast spin echo pulse sequence?

A. Decrease of TE
B. Decrease of TR
C. Decrease of echo train length
D. Decrease of slice thickness

(D) MRI Instrumentation

- Design of various magnet systems used in MRI
- Spatial encoding gradient coils
- Radiofrequency system including phase array coils
- Basic quality assurance of MRI system

Sample question

Which is wrong regarding the function of gradient coils?

A. Frequency encoding of MRI signal
B. Control of thickness of imaging slice
C. Control of flip angle of radiofrequency pulse
D. Phase encoding of MRI signal

(E) Imaging Artifacts

- Recognition of imaging artifacts induced by the system hardware, pulse sequences, poor operator choices, physiological and patient motion etc.
- Basic principles of MRI artifacts and corresponding compensation techniques
- Motion artifacts
- Aliasing or wrap-around artifacts
- Magnetic susceptibility artifacts
- Gibbs or truncation artifacts
- Chemical shift artifacts
- RF leakage or Zipper artifacts
- Moire fringes
- Magic angle artifacts
- Other imaging artifacts due to hardware failure

Sample question

Magic angle artifact is commonly occurred in

A. Long TE pulse sequence
B. Fast spin echo sequence
C. Gradient echo sequence
D. Short TE pulse sequence

(F) MRI Contrast Media

- Extra-cellular contrast agents
- Tissue-specific contrast agents
- Intravascular or blood pool contrast agents
- Positive & negative contrast agents
- Safety of MRI contrast agents

Sample question

The recommended dosage of Gadolinium-based MR contrast agent with concentration of 0.5M (Molar) is

A. 2 mmol/kg
B. 1 mmol/kg
C. 0.5 mmol/kg
D. 0.1 mmol/kg

(G) MRI Anatomy & Pathology

- Neuro-anatomy including grey/while matter differentiation, ventricular system and vascular structures
- Spinal anatomy
- Musculoskeletal anatomy
- Body anatomy including thorax, abdomen and pelvis
- Common MRI pathologies and their MRI appearances

Sample question

Focal fatty infiltration or sparing of liver is commonly demonstrated by

A. Fast spin echo T2-weighted pulse sequence
B. Fast gradient echo T1-weighted pulse sequence
C. Chemical shift imaging
D. Diffusion weighted imaging

Suggested Reading Materials

These reading materials would provide the candidates with a sound understanding necessary to complete the Certification Examination of MRI. The suggested texts and references are provided as alternative sources of information that will assist the candidates and are not considered to be mandatory reading.

- MRI in Practice – 2nd edition; Westbrook & Kaut; Blackwell
- MRI From Picture to Proton – 2nd edition; McRobbie, Moore, Graves & Prince; Cambridge
- Reference Manual for Magnetic Resonance Safety, Implants, and Devices: 2008 edition; Shellock; Biomedical Research Publishing Group

- Magnetic Resonance Bioeffects, Safety, and Patient Management; Shellock & Kanal; Raven Press
- Pocket Atlas of Cross-sectional Anatomy: CT and MRI – Volume 1 & 2; Moller & Reif; CIC Edizioni Internazionali
- 3D Contrast MR Angiography – 2nd edition; Prince, Grist & Debatin; Springer
- Cardiovascular MRI: Physical Principles To Practical Protocols; Lee; Lippincott Williams & Wilkins
- MRI Survival Guide; Cardoza & Herfkens; Raven Press
- High Field Brain MRI; Salvolini & Scarabino; Springer

Requirements of MRI Clinical Experience

The candidates are required to complete 300 MRI examinations within a 2-year period. The 300 MRI examinations shall include:

- Not less than 120 MRI examinations of head & neck
- Not less than 80 MRI examinations of spine
- Not less than 60 MRI examinations of musculoskeletal regions
- Not less than 40 MRI examinations of thorax, abdomen and pelvis

The clinical component requires the candidate's supervisor to acknowledge completion of the required clinical examinations.

{Please refer to Appendix I for the Statement of Clinical Training in MRI for Admission of Member of HKCRRT}

Appendix I

The Hong Kong College of Radiographers and Radiation Therapists

Statement of Clinical Experience in Magnetic Resonance Imaging for Admission of Member of HKCRRT

This statement must be completed in full and signed by the applicant and his/her supervisor before it can be processed. The HKCRRT reserves the right to request the applicant to provide the detailed records of clinical experience.

To be completed by the applicant

Title (circle one): Mr. Mrs. Ms. Dr.

Surname: _____ Given Name: _____

Address: _____

_____

Tel. (Work): _____ Tel. (Mobile): _____ E-mail: _____

Certification Examination of MRI of HKCRRT undertaken on _____(dd/mm/yy)

I, _____ certify that I have performed not less than 300 MRI examinations including:

- **Not less than 120 MRI examinations of head & neck**
- **Not less than 80 MRI examinations of spine**
- **Not less than 60 MRI examinations of musculoskeletal regions**
- **Not less than 40 MRI examinations of thorax, abdomen and pelvis**

during the 2-year period between _____ (mm/yy) and _____ (mm/yy)

Supervisor's Verification

I, _____ supervisor of the individual identified on the statement verify that the individual has successfully completed 300 MRI examinations during the time period described above.

Signed: _____ Date: _____

Position: _____ Name of Institution: _____