

Integration of MRI into Radiation Therapy

Enhanced practice authorization program for radiation therapists – Limited to CCI

This guide is designed to provide the radiation therapists with information about MRI integration into radiation therapy enhanced practice authorization program approved by the Alberta College of Medical Diagnostic and Therapeutic Therapists (ACMDTT).

The *Health Professions Act* (HPA) identifies the practice of radiation therapists to be uniquely distinct from the practice of magnetic resonance imaging. As such, therapists registered on the radiation therapy register are not authorized to apply magnetic resonance in conjunction with radiation therapy.

Under the provision of the HPA and s.19(1) of the *Medical Diagnostic and Therapeutic Technologists Profession Regulation*, a regulated radiation therapist who has completed advanced training, approved by ACMDTT Council, may be authorized by the Registrar to both apply ionizing radiation in conjunction with magnetic resonance.

The objective of the College in authorizing a program in the integration of MRI into Radiation Therapy is to prepare therapists to safely and competently use Magnetic Resonance Imaging (MRI) in conjunction with radiotherapy on a linear accelerator or radiation therapy simulator to treat cancers throughout the body (excluding muscular skeletal anatomy) within the clinical setting. The information contained in this guide describes the expectations and goals, both academically and clinically, that the therapist must achieve in order to be successful in this program.

Evolving technology and the growing use of multiple forms of imaging are blurring the lines between the disciplines of medical radiation technology. MRI is quickly becoming a standard imaging modality in the planning and treatment of RT. MRT(T)s using MRI technology, require an enhanced license to practice as per ACMDTT in Alberta

The MRI in Radiation Therapy enhanced practice authorization program consists of both didactic and clinical components. These components are outlined, and further broken down, in the next section. A therapist must have completed the courses of the didactic component of the program prior to completing the clinical component.

Maintenance of enhanced practice authorization

Each year, during renewal, the radiation therapist with the MRI in RT enhanced practice authorization will be required to apply for renewal of this authorization. In addition to the online renewal of their practice permit, the therapist will be required to submit a *Renewal of Additional and Enhanced Practice Authorization* form.

Program components

To achieve enhanced practice authorization, the College is standardizing the additional education required for a radiation therapist to use Magnetic Resonance Imaging (MRI) in conjunction with radiotherapy on a linear accelerator or radiation therapy simulator to treat cancers throughout the body (excluding muscular skeletal anatomy). In addition, due to differing demographics and experience among radiation therapists' registrants, the following program strives to address the learning and experiences of both new graduates and practiced therapists.

In order to successfully complete the program, the therapist must complete the appropriate didactic and clinical requirements for the program.

Program Outline

Competency workbook

- Clinical competencies
 - Safety
 - Equipment and Imaging
 - Practical Tasks
- Task 1-4
- Scenario 1-4
- Case Studies 2
- Clinical Time Log

Program requirements

The Linac MR is a new type of technology that incorporates the Aurora-RT™ MRI system with a 6MeV Linac or an equivalent hybrid system. In addition to the hazards associated with high-energy radiotherapy systems these systems introduce MRI safety hazards, and require additional knowledge, skills and competence in order to operate it safely and efficiently.

All therapists must apply to the College for enhanced practice. In addition to providing a completed Application for Additional and Enhanced Practice, please provide evidence of completion of the following:

Applicant must provide proof of current practice evidence of ACMDTT registration.

Requirements	Didactic	Clinical
¹ NAIT course completion	PHYS1110 MRI Physics I MRID1280 MRI Cross Sectional Anatomy I MRID1230 MRI Equipment and Safety PHYS1210 MRI Physics II MRID1330 MRI Techniques and Application	Cancer Control Alberta Clinical Manual for RT-MR RT-MR Online Clinical course

¹ NAIT – Northern Alberta Institute of Technology

² CCI – Initial clinical time will be spent on diagnostic MRI at CCI before the Aurora-RT™

It is required that the therapist complete foundation didactic teachings in MRI theory, prior to commencing the clinical component:

Final Submission

All of the applicable items must be submitted to the Registrar prior to receiving the enhanced practice authorization to apply magnetic resonance in conjunction with radiation therapy.

Submit the full package including the following completed documents:

- completed Additional and Enhanced Practice Authorization Application
- proof of successful completion of the didactic component, including MRI theory assessment
- proof of successful completion of clinical component
- proof of Micro-Credential parchment

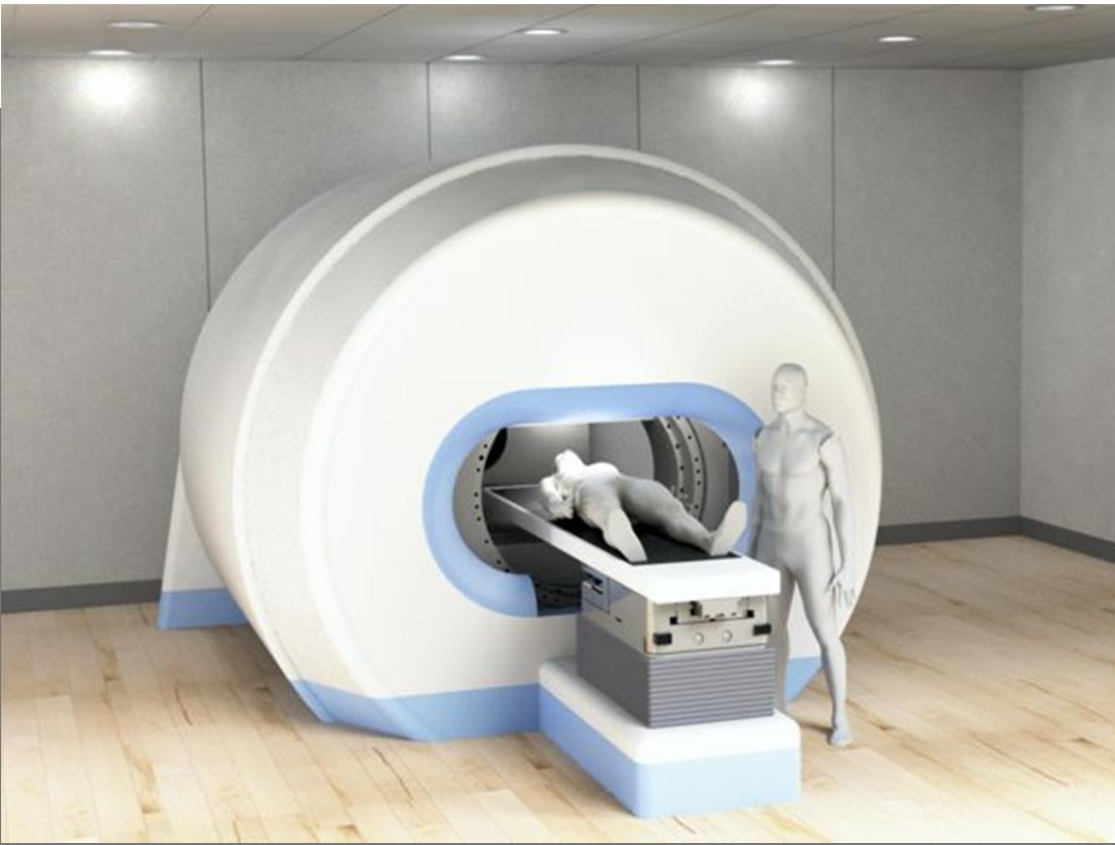
Submit to:

Registrar
Alberta College of Medical Diagnostic and
Therapeutic Therapists
Suite 800, 4445 Calgary Trail
Edmonton AB T6H 5R7

F| 780.432.9106
E| info@acmdtt.com

Integration of MRI into Radiation Therapy

Cancer Control Alberta Clinical Manual for radiation therapists
Limited to CCI



Applicant Information

Name: _____ ACMDTT #: _____
Address: _____ Email: _____
Phone #: _____

Practicum Information

Facility: Cross Cancer Institute Department(s): Radiation therapy
Primary Clinical Supervisor: _____
Email: _____ Phone #: _____
Start Date: _____ End Date: _____

Successful Completion

The applicant must pass all NAIT didactic course noted above and then successfully complete all aspects of the clinical Competency Workbook, and clinical course.

To receive an enhanced license for MR in RT the official transcript and completed signed clinical Competency Workbook will be submitted to ACMDTT for assessment.

Competency Assessment Performance Expectations

The applicant who is placed in the clinical environment will be assessed according to the following performance expectations:

Application of didactic knowledge

1. accurately interprets the requisition
2. accurately and independently produces images
3. provides for accurate patient exams/studies in an orderly progression of tasks
4. provides MRI patient screening
5. adheres to high standards of radiation and MRI safety while performing the procedures
6. ensures operational readiness of equipment for a procedure/study
7. determines and selects optimal factors based on individual case variables
8. accurately critiques the MRI images which are produced
9. correctly performs quality control procedures according to manufacturers' operational standards
10. exemplifies a strong understanding of professional and regulatory standards of practice

Patient relationships

1. identifies self and explains the provider's role
2. confirms the identity of the patient
3. demonstrates respect for patients' rights to make choices and to be fully informed
4. responds appropriately, and in a timely manner, to all patient inquiries
5. protects the patient's confidentiality and takes measures to ensure patient privacy
6. demonstrates sensitivity when dealing with diverse patient populations
7. provides accurate information and checks for understanding

Work team relationships

1. supports the work of the team and shares the workload equitably
2. demonstrates a willingness to learn from various members of the team
3. showcases efforts which are clearly focused and on task
4. exemplifies communication that is meaningful and relevant to the work
5. demonstrates flexibility to changing routines
6. seeks and responds appropriately to feedback

Program sequencing

It is required that the therapist complete the following MRI didactic courses prior to clinical. These courses can be completed full-time or part-time.

NAIT

- PHYS1110 MRI Physics I
- MRID1280 MRI Cross Sectional Anatomy I
- MRID1230 MRI Equipment and Safety
- PHYS1210 MRI Physics II
- MRID1330 MRI Techniques and Application

Competence Workbook

- Clinical competencies
 - Safety
 - Equipment and Imaging
 - Practical Tasks
 - Task 1-5
 - Scenario 1-4
 - Case Studies 2
- Clinical Time Log

Criteria for competency

By having verifiable competencies in these documented procedures of the clinical component, it is imperative that the radiation therapist has demonstrated, through independent actions, the ability to use Magnetic Resonance Imaging (MRI) in conjunction with radiotherapy on a linear accelerator or radiation therapy simulator to treat cancers throughout the body (excluding muscular skeletal anatomy).

Competency substitutions

In acknowledgment of differences in practice, both regionally and from site-to-site, and the limited availability of Linac MR, flexibility in the attainment of competency will be allowed in the 'RT MR Procedures' category. Frequency of the exam and regional and facility differences will dictate the assessment environment. However, every attempt must be made to assess performance in the clinical environment when possible.

Clinical timeframe

In completion of this program, it is expected that the therapist spends a minimum of 6 weeks with a minimum of 230 clinical hours in a MRI environment. This may be in a dedicated MRI or on a Linac MR department. Therapists will record the hours worked in these areas on the Clinical Time Log that can be found in this manual.

Acknowledgments

Special thanks to Cynthia Eccles, (Christie NHS trust) and her team for sharing their clinical workbook material. Also, many thanks to Joy Lutz, Chery Keen, Sara Schroffel, Ayman Darwish (NAIT MRI faculty), Brad Murray and Brandon Aboughoche (CCA), Pree Tyagi (ACMDTT), and Carrie Bru (CAMRT) for help developing the clinical competency workbook.

Clinical Competencies

For the competencies listed below, the applicant is to be evaluated according to the Performance Expectations outlined on Page 1 of this manual. In order to achieve competence assured for each examination below, it is expected that the therapist will have performed the examination protocol more than once and will maintain competence in the examination procedure post competence assurance.

I. Safety

Procedure	Examination Date	Signature of Verifier
Clinical orientation to include:		
Complete MR Linac safety questionnaire		
Define MR Linac zones/access issues		
Identify Position of emergency/fire alarms		
Identify position of MRI safe fire equipment		
Examine crash cart, emergency drugs and defibrillator		
List of storage areas containing stock		
Identify safe positioning aids for MRI		
Identify MRI safe or conditional stretchers and chairs		
Identify MRI safe equipment – Ex. Labelling / safety list		
Demonstrate cleaning procedures and documentation		
Linac MR Local Rules		
Read Linac MR local rules and discuss		
Demonstrate knowledge of patient pathway		
Linac MR screening		
Explain rationale of checklist questions		
Outline procedure for foreign bodies in orbits		
Demonstrate process for changing and prepping patients/volunteers: see local rules		
Demonstrate coil safety and placement safety procedures for:		
Insulation		
Looped cables		
Hands unclasp		
Skin-to-skin contact		

Explain why one does not leave the unplugged coil on near the bore		
Demonstrate Patient Positioning		
Appropriate RT positioning within coil/treatment apertures		
Explaining scan procedure to the patient ~noise/ear protection, movement, call bell <ul style="list-style-type: none"> • call bell • lying still • use of skin markers • comfort/temperature 		
Perform mock emergency drills		
Magnet emergency shutoff procedure		
Cardiac Arrest drill		
Fire evacuation procedure		

II. Equipment and Imaging

For each examination, aside from performing the scanning protocol, the therapist is expected to perform any image reconstruction and archiving required of the imaging facility.

Examination	Examination Date	Signature of Verifier
Explain and perform a morning QA to include:		
Switching on the system and workstations		
Completing QA		
Check O2 and suction		
Performing any troubleshooting		
Check defibrillator		
Check and restock emergency cart		
Prepare for first patient exam		
Complete Administrative duties to include:		
Explain checklist documentation		
Identify scanning documentation		
Compare archiving, exporting and sending of images		
Demonstrate Competency with Scanning Platform by:		
Enter patient/volunteer from scheduling system		

Enter patient/volunteer manually		
Schedule patient		
Select exam card		
Delete and add exam card		
Recognize tissue contrast variations on these sequences:		
T1 & T1FS		
T2, T2FS, & T2*		
PD		
Fat-water separated Dixon Method		
Short Tau Inversion Recovery		
DWI		
Perform the following scan for each tumor site evaluating specifics:		
Abdomen (liver, pancreas, spleen)		
Pelvis (bladder, cervix, rectum)		
Thorax		
Head and Neck		
Chest (including 4D and navigated sequences)		
Brain		
Perform scout views		
Evaluated Localizer		
Windowing		
Manipulation of scan parameters and the reasons for their use (if applicable):		
TR		
TE		
Flip Angle		
ETL		
FOV		
Slice Thickness/Spacing		

TI		
Matrix		
No Phase Wrap Phase Oversampling		
Phase/Frequency directions		
Acquisitions (NEX)		
Manipulate workstation images to demonstrate:		
Stack/compose		
Transfer motion sequences for reconstruction		
Explain and perform an evening shut down to include:		
Check all data exported		
Shutdown system and workstations		
Lock Linac MR room and dim lights		
Check ready for next day (patients list, supplies, etc.)		
Check changing rooms and toilet		

I. Practical Tasks

Use the appropriate practice sheets to follow the outlined process and record results on the accompanying worksheet for tasks 1-4 below

Task 1: Adapting a sequence from T1TSE to T2TSE

Overview:

During this exercise, you will change the parameters in a T1TSE such that the result will be a T2TSE protocol.

Objectives:

After completing this task, you will be able to change a T1TSE protocol into a T2TSE

Task 1	Completion Date	Signature of verifier
<i>Adapting a sequence from T1TSE to T2TSE</i>		

Task 2: Adjustment of acquisition time (TA)

Overview:

During this exercise you will change parameters in relation to the matrix, the number of slices and NSA to see the influence on scan time.

Objectives:

After completion, you will be able to;

- Predict the influence of the matrix, number of slices, NSA and scan mode on the TA
- Explain the difference between MS, M2D, 3D
- Understand the difference between stack and package

Task 2	Completion Date	Signature of verifier
<i>Adjustment of acquisition time (TA)</i>		

Task 3: Influencing signal-to-noise ratio (SNR)

Overview:

During this exercise, you will change your parameters which have a relationship to the SNR. These parameters are TE, TR, voxel size, NSA and WFS.

Objectives:

After completing this exercise, you will be able to describe how TE, TR, voxel size, NSA and WFS affect SNR

Task 3	Completion Date	Signature of verifier
<i>Influencing signal-to-noise ratio (SNR)</i>		

Task 4: Altering resolution worksheet

Overview:

During this exercise, you will understand more about resolution

Objectives:

After completing this exercise, you will be able to;

- Explain what resolution means
- Explain pixels and voxels

Understand the relationship between FOV, matrix, slice thickness and pixel/voxel size

Task 4	Completion Date	Signature of verifier
<i>Altering resolution worksheet</i>		

Task 5: MRI Screening

Overview:

During this exercise, you will screen a patient thoroughly for their MRI Procedure

Objectives:

After completing this exercise, you will be able to;

- Explain the difference between screening an inpatient vs. outpatient
- Explain how to lookup implants (if Pt. has them)
- Understand the importance of removing or clearing all metal and/or foreign objects on or inside your Pt.'s before the exam

Handle Pt.'s accessory equipment and the use of switching to MRI safe/compatible equipment

Task 5	Completion Date	Signature of verifier
<i>MRI Screening</i>		

Scenarios:

Below are some scenarios for you to reflect on. Please describe what you would do in each of them to your preceptor.

Scenario 1:

You are screening a patient and they have an implant that you don't recognize. The patient has had an MR before. What do you do?

	Completion Date	Signature of verifier
<i>Scenario 1</i>		

Scenario 2:

An Aurora-RT™ engineer arrives and says they have been screened before and is authorized to work un-supervised, what do you do?

	Completion Date	Signature of verifier
<i>Scenario 2</i>		

Scenario 3a:

Choose 3 artifacts from the artifact library. Describe their appearance and consider what may have caused them and what strategy you might use to reduce their appearance (if possible).

	Completion Date	Signature of verifier
<i>Scenario 3a</i>		

Scenario 3b:

Choose 2 other artefacts that you have encountered while imaging. Describe their appearance and consider what may have caused them and what strategy you might use to reduce their appearance.

	Completion Date	Signature of verifier
<i>Scenario 3b</i>		

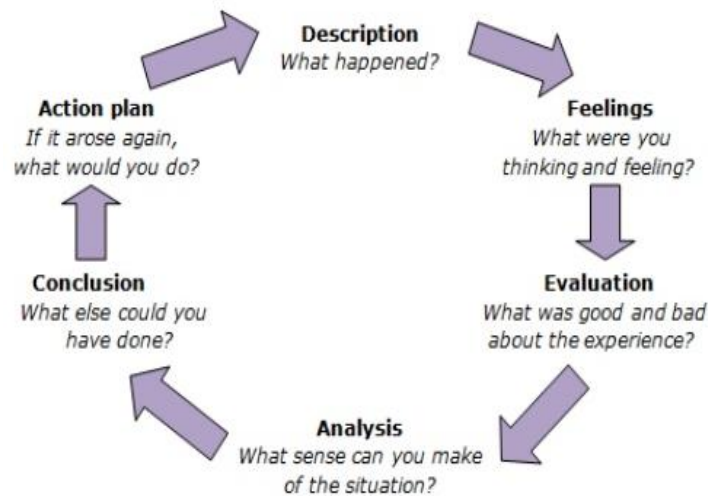
Scenario 4:

The communications office calls to arrange a tour of the MR Linac to potential legacy donors. You confirm this has been "approved" by the appropriate department heads. What do you need to do in preparation for and at the time of the visit to ensure all staff and visitors are safe and local rules are adhered to?

	Completion Date	Signature of verifier
<i>Scenario 4</i>		

Case studies:

Please think of 2 cases that have interested you and write a reflective report. The template below is Gibbs' cycle for reflective learning but please adapt it to suit your own style



	Completion Date	Signature of verifier
<i>Case Study 1</i>		
<i>Case Study 2</i>		

Clinical Time Log

Required Clinical Practicum Hours

The applicant must attain the required minimum of 230 hours of clinical experience within the MRI environment as one condition of the authorization criteria established by the College

Date	Hours	Signature of Verifier

Total Hours: _____

Make copies of this form, as required

Signing Authority for Verification of Achievement

- A clinical MRI Technologist hired to work on the Aurora-RT™ MRI
- An MRT(T) with an enhanced license in MR
- An MRI technologist MRT(MR) (for Diagnostic MRI Rotation)
- A Medical physicist proficient in the workings of Aurora-RT™ MRI

These people can attest to the clinical competencies achieved by the applicant. Questions regarding the appropriateness of supervision should be directed to the Senior Practice Leader for Radiation Therapy.

Name of Verifier	Current Position	Email	Signature

Verification of Successful Completion

Technologist Verification

I verify that I have successfully completed all aspects of the clinical learning experience outlined in the Computed Tomography and Contrast Media enhanced practice authorization program.

Applicant Signature

Date

Clinical Practicum Site Verification

I verify that all aspects of the clinical learning experience have been successfully achieved by the applicant.

Signature of Primary Clinical Supervisor

Date

