



MEDICAL RADIOGRAPHY

Clinical Preadmission Information

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Selection Process Information

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Medical Radiography Program

Selection Process

There is significant competition for acceptance into the Medical Radiography Program. In order to ensure fairness to the applicants and to graduate a high caliber technologist the following selection process is followed:

1. Applicants must have prerequisites completed. Obtaining minimum requirements does not mean automatic acceptance. Selection is dependent on overall merits of the applicant.
2. All applications are reviewed and the most eligible are invited for an interview. Interviews are conducted by Program staff and the admissible applicants are invited to a clinical site for clinical preadmission orientation.
3. At the end of the clinical preadmission orientation, applicants will complete a multiple choice exam. A report based on feedback from the clinical site will be forwarded to BCIT.
4. Selection into the program will be based on scores achieved during interview, clinical preadmission visit, and exam.

**Canadian Association of
Medical Radiation Technologists
(CAMRT)**

Code of Ethics

The CAMRT Code of Ethics has been developed by members to articulate the ethical behaviour expected of all medical radiation technologists and to serve as a means for reflection and self evaluation. Members of the Canadian Association of Medical Radiation Technologists (CAMRT) recognize their obligation to identify, adopt and promote exemplary professional standards of practice, conduct and performance.

While performing professional activities, medical radiation technologists shall uphold the vision of the Canadian Association of Medical Radiation Technologists (CAMRT) by adhering to the following tenets of ethical conduct.

Patient respect and dignity

Medical radiation technologists shall:

- Treat patients and families with respect and dignity;
- Assist patients and families to make informed decisions regarding care;
- Facilitate the patient's free and informed choices;
- Provide the patient with an accurate description of all procedures and associated risks in a truthful and comprehensible manner;
- Answer patient questions fully and honestly within the limits of their knowledge and authority/responsibility;
- Participate in the formal consent process by ensuring patient willingness to participate in the procedure;
- Respect the patient's right to refuse or withdraw from treatment;
- Take steps to ensure the physical privacy of the patient;
- Maintain the confidentiality of information provided by or about the patient, as well as anything contained in the patient record, except as part of standard therapeutic information sharing within the health care team, or where required by law.

Patient centered care and safety

Medical radiation technologists shall:

- Practice only those procedures for which the member is qualified, or has been properly delegated by the appropriate institutional authority, where the member has the requisite knowledge, skills and judgment to ensure competence;
- Practice only those disciplines of medical radiation technology in which the member is certified by the Association and is currently competent;
- Incorporate risk management principles into routine practice in order to minimize risk;
- Conduct all procedures and examinations in keeping with current safety standards;
- Make use of appropriate professional and institutional mechanisms to intervene when witness to unsafe, incompetent or unethical practice.

Fairness, accountability and integrity

Medical radiation technologists shall:

- Provide care to all regardless of race, national or ethnic origin, color, gender, sexual orientation, religious or political affiliation, age, type of illness, mental or physical ability;
- Prioritize the use of resources according to need;
- Utilize and distribute resources over which they have control in a fair and responsible manner;
- Be accountable for their actions and conduct themselves with honesty and integrity in all of their professional interactions;
- Avoid any activity that creates a conflict of interest or violates any local, provincial or federal laws and regulations;
- Avoid exploiting the vulnerability of patients by entering into dual or non-therapeutic relationships;
- Advocate for working environments that support safe, competent and ethical practice;
- Assume responsibility for errors committed and take immediate action to prevent or minimize associated harm;
- Recognize that while patients must seek diagnostic information from their physician, an impression expressed to another health care professional with regard to the appearance of a procedure or examination may assist in diagnosis or treatment;
- Educate patients, students and professional colleagues about practices and procedures pertinent to medical radiation technology;
- Reflect on practice to promote the development of informed, knowledgeable and safe practice;
- Monitor their performance to ensure continuing competence;
- Contribute to interdisciplinary collaboration and the development of partnerships which contribute to positive patient outcomes;
- Strive to be a role model for other members of the health care team by demonstrating responsibility, cooperation, accountability and competence in meeting the health care needs of the public;
- Participate in continuing professional development, research and the utilization of best practice methods;
- Participate in collaborative problem solving to promote knowledge transfer and exchange, support appropriate decision making and facilitate human resource succession planning;
- Participate in the affairs of the Association in a responsible and professional way.

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Clinical Preadmission Orientation Objectives

The goal of the clinical orientation day is to:

1. provide an opportunity for the applicant to become fully aware of the scope and extent of radiography in the clinical environment and its demands upon those practicing radiography.
2. allow clinical staff an opportunity to provide feedback for selection purposes.

Preadmission Orientation Objectives

During the clinical site visit, the applicant will:

1. become familiar with a medical imaging department.
2. become familiar with a variety of radiographic exams. These exams should include, but not be limited to:
 - extremities
 - chest
 - abdomen
 - spine
 - fluoroscopy

The applicant can become familiar with cases not observed during the clinical orientation by referring to radiographic textbooks in the department.

3. meet the departmental staff (manager, technologists, medical staff and health care team members).
4. become aware of the organization, personnel policies and function of a medical imaging department.
5. gain a general overview and introduction to radiological technology and to understand the roles of the different disciplines included in “medical imaging.”
6. be made aware of the function/duties of the radiologist and the radiographer/technologist.
7. become familiar with imaging methods.
8. gain an awareness of the potential hazards associated with the use of ionizing radiation, and safety measures implemented.

Glossary

Knowledge of the following terms and procedures will enhance the preadmission orientation experience.

Basic Terms in Medical Radiography

<i>Anatomical Position</i>	Images are viewed in the anatomical position which refers to the patient standing erect, facing forward with the palms of the hands facing forward.
<i>Bucky</i>	A mechanism for moving the grid. (Potter-Bucky Diaphragm) — also see grid.
<i>Cassette</i>	A light-tight container lined with intensifying screens. The radiographic film is placed between the pair of screens. Also see <i>intensifying screens</i> .
<i>Central Ray</i>	The geometric center of the beam of radiation emitted from the x-ray tube.
<i>Chart</i>	The complete record of past and current data kept for each patient containing details such as history, results of diagnostic tests, signs and symptoms, vital signs, physician's findings, nurse's notes, medications administered.
<i>Collimation (Coning)</i>	A term used by technologists to refer to the activity of limiting the field of radiation produced.
<i>Collimator</i>	An adjustable shutter system mounted over the tube "window" for the purpose of limiting and shaping the field of radiation; can be automatically programmed to cassette size.
<i>Collimator Light</i>	A light source in the collimator which simulates the field of radiation to be provided.
<i>Compression Band</i>	A broad band of cloth or plastic which attaches to the x-ray table and helps to immobilize patients during radiographic examinations.
<i>Computed Radiography</i>	CR uses digital technology with a photostimulable phosphor plate within a cassette in order to produce digital images.
<i>Consent Form</i>	Legal document completed and signed by patient and technologist/radiologist. This confirms invasive radiographic procedure has been explained and patient is agreeable to continue.
<i>Contrast Media</i>	A group of substances utilized for introduction into a body organ, cavity or vessel to make visualization possible on the resultant radiograph.
<i>Control Panel</i>	The areas of the x-ray machine where kilovoltage, milliamps, exposure time, etc. is selected and monitored. The equipment component used to regulate radiation by adjusting kilovoltage, milliamperage and exposure time.

<i>Digital Radiography</i>	DR uses digital technology and special electronic detectors to produce digital images.
<i>Digitizer/CR Reader</i>	Converts the scanned electronic signal from the imaging plate for image display on a monitor.
<i>Distance Indicator</i>	A metal tape measure or alternate device which measures the distance from the source of radiation within the tube to the radiographic film (source to image distance).
<i>Emergency Cart (Kit)</i>	A container with contents systematically organized for use during patient emergencies, providing necessary emergency medications, syringes, swabs, tourniquet, blood pressure cuff, etc.
<i>Exposure Factors</i>	Safe exposure to the patient requires specific selection of a variety of parameters to obtain a diagnostic image. These factors are: <ul style="list-style-type: none"> • kVp – kilovolt peak • mA – milliamperere • S – time of exposure • D – Distance
<i>Filter</i>	A compensating device used to absorb radiation to provide a more uniform image when the patient's body part is of uneven thickness. It is commonly placed between the patient and the x-ray tube or between the patient and image receptor.
<i>Fluoroscopy</i>	A method of radiographic examination in which a continuous and immediate image is produced and displayed on a television monitor.
<i>Gonad Shield</i>	A device composed of lead impregnated rubber, which will stop radiation. Used for protection of the ovaries or testicles during radiography.
<i>Grid</i>	A device composed of alternating thin strips of lead and a radiotransparent material. Mounted between the patient and the image plate (IP) to absorb scattered radiation. This prevents scatter from reaching the IP.
<i>Image Plate or Image Receptor</i>	This is a special plate that stores the latent image until it is converted into a digital image. The device that converts the x-ray beam into an image.
<i>Intensifying Screen</i>	A thin sheet of plastic coated with a thin layer of small phosphor crystals, which emits light when bombarded with radiation. The radiographic film is placed between a pair of intensifying screens contained within a cassette. The radiographic film receives the emitted light to produce an image.
<i>Mobile X-Ray Machine</i>	Movable x-ray machine brought to patient's bedside.
<i>OID</i>	Object-to-image distance is how far the body is to the image receptor.
<i>PACs</i>	Picture archiving and communication system permits the acquisition, interpretation and storage of images.

<i>Patient Position</i>	Refers to the patient position when radiographed: <ul style="list-style-type: none"> • supine — patient lying on their back. • prone — directly on their abdomen. • lateral — directly on their side. • oblique — at any angle in between prone/supine and lateral.
<i>Patient Requisition</i>	Legal document completed by a physician requesting a radiographic examination of the patient.
<i>Radiation</i>	Electromagnetic radiation with penetrating properties.
<i>Safelight</i>	A light source in the processing area (darkroom) which is covered with a colored filter. This protects the film during processing/handling.
<i>SID</i>	Source image distance is the distance from the source of the radiation to the image receptor (from the x-ray tube to the cassette).
<i>Standard Precautions</i>	Specific clinical techniques to reduce/prevent the spread of communicable disease. These include hand washing, protective apparel, patient placements, management of medical equipment and supplies.
<i>Suction Unit</i>	A vacuum bottle with tubing attached for the purpose of withdrawing fluid from a body cavity.
<i>TLD/OSL</i>	Thermoluminescent Dosimeter/Optical Stimulated Luminescence — a device worn by radiation workers for measurement of radiation dose.
<i>Traffic Desk</i>	Area of x-ray department that handles processing of patient requisitions. Designated person organizes booking times/rooms/technologists for daily workload.
<i>X-Ray Tube</i>	A glass envelope containing an anode and a cathode. When the cathode is heated it emits electrons which on striking the anode result in the production of radiation.

Sample of Radiographic or Imaging Procedures

Angiography

An examination of blood vessels in the body made possible by injecting contrast medium into an artery or vein and following its passage through the body. A series of radiographs are taken post-injection to evaluate the vessels.

Arthrography

An examination of a bony joint, i.e., a junction where two or more bones meet. To demonstrate the internal structure(s) and function of that joint. Contrast media is injected and radiographs are obtained with the joint in several different positions.

Gastro Intestinal Examinations (GI)

- *Barium Enema*

An examination of the large bowel (colon) by introducing a liquid contrast medium called barium sulphate. To examine the bowel, it must be completely empty, so the patient is requested to fast for eight hours prior to the examination. The radiologist observes the passage of the barium sulphate with fluoroscopy and radiographs any area of interest.

Please note: A **double contrast examination** may be performed when doing a barium enema or barium meal. In this case, two types of contrast media are used together — barium sulphate and air. Barium sulphate will appear white on the radiograph and coat the lining of the digestive tract; air will appear black on the radiograph and fill the structure being examined. Details of the digestive lining will be visualized.

- *Stomach and Duodenum (S & D)*
or
Upper GI (UGI)

Also known as Upper GI or Upper Gastrointestinal series. These images are used to evaluate the esophagus, stomach and small intestine. The patient is required to drink various suspensions of barium sulphate in addition to taking gas producing tablets. Images are taken under the direction of the radiologist using fluoroscopy in various positions.

<i>Small Bowel Follow Through (SBFT)</i>	An examination of the small bowel often follows the examination of the upper gastrointestinal tract, including esophagus, stomach and duodenum. The patient is requested to drink several glasses of liquid contrast medium called barium sulphate. A timed sequence of radiographs of the patient's abdomen is obtained. For example, 15 minutes, 30 minutes, 1 hour, 2 hours, 4 hours. The series is continued until the barium sulphate has passed to the final portion of the small bowel.
<i>Computed Tomography (CT)</i>	Computerized Tomography (CT scanning) combines a fan-shaped x-ray beam traversing the patient and detectors receiving the beam. The beam received is digitized and a computer uses the measurements to reconstruct a cross-sectional image of the patient. A method of obtaining an image of a thin section of the body, without superimposition of structures above and below the plane of interest, e.g., "slice."
<i>Cystography</i>	An examination of the urinary bladder by filling with a contrast medium introduced through a small tube passed via the urethra to the bladder. Radiographs of the bladder and urethra are obtained during the procedure. For careful examination, the bladder must be empty, so the patient is asked to void immediately before the procedure begins.
<i>ERCP (Endoscopic Retrograde Cholangiopancreatography)</i>	ERCP is a procedure used to examine the biliary and pancreatic ducts. The patient is sedated. This procedure is done by passing a fiber optic endoscope through the mouth into the duodenum under fluoroscopic control. Contrast is injected into the common bile duct and pancreatic duct and radiographs taken with the patient in different positions. This examination is usually done following an ultrasound which indicates abnormalities of the biliary system.
<i>Intravenous Pyelography (IVP)</i>	An examination of the urinary tract, including kidneys, ureters and bladder, by the introduction of contrast medium into a vein at the elbow. The contrast medium is carried through the bloodstream to the kidneys, where it is excreted. Within a minute of the injection, the contrast medium will be present in the kidneys and will flow down into the ureters and bladder. A timed sequence of radiographs are obtained until all three parts of the urinary tract have been adequately visualized.
<i>Mammography</i>	A radiographic examination of the breast. Patient/equipment is placed in two or three different positions.

Recommended Safety Procedures for Radiation Use

Diagnostic x-rays are an essential part of present day medical practice in North America; over 60% of the population with access to modern medical care undergo radiological procedures each year. Over half of all important decisions for the welfare of patients are based on valuable tools used in modern health care.

Although individual doses are usually small, in total exposure, diagnostic x-rays account for the major portion of man-made radiation exposure to the general population. However, with well-designed, installed and maintained x-ray equipment, and through use of proper procedures by trained operators, unnecessary exposure to the patients can be reduced significantly, with no decrease in the value of medical information derived. To the extent that the patient exposure is reduced, there is, in general, a decrease in the exposure of machine operators and other health care personnel.

The need for radiation protection exists because exposure to ionizing radiation can result in deleterious effects that manifest themselves not only in the exposed individual but in his descendants as well. These effects are called somatic and genetic effects, respectively. Somatic effects are characterized by observable changes occurring in the body organs of the individual exposed. These changes may appear within a time frame of a few hours to many years, depending on the amount and duration of exposure of the individual. Genetic effects are an equal cause for concern at the lower doses used in diagnostic radiology. Although the radiation doses may be small and appear to cause no observable damage, the probability of chromosomal damage in the germ cells, with the consequence of mutations giving rise to genetic defects, can make such doses significant when considered for a very large population.

There are four main aspects of the problem to be considered. Firstly, radiological procedure should be based on a demonstrated medical need. Secondly, when radiological procedures are required, it is essential that patients be protected from excessive radiation during the exposure. Thirdly, it is necessary that personnel in radiology departments be protected from excessive exposure to radiation in the course of their work. Finally, personnel in the vicinity of radiology facilities and the general public require adequate protection.

While for radiation workers and the general public maximum permissible levels of exposure have been defined, no specific levels have been recommended for patients undergoing diagnostic x-ray procedures. For patients the risk involved in the exposure MUST always be weighed against the medical requirement for accurate diagnosis. However, there MUST always be a conscious effort to reduce patient exposures to the lowest practical levels and to eliminate “unnecessary” exposures.

Introduction from Safety Code 20A, X-ray Equipment in Medical Diagnosis

Math Requirements for the Medical Radiography Program

Students should be comfortable with the following mathematical ideas.

- sketch linear, quadratic, exponential and log^e functions

- solve: linear algebraic functions
 $y = mx + b$

quadratic function
 $y = a_0 + a_1x + a_2x^2$

exponential function power function
 $y = Ae^{bx}$ $y = Ax^6$

log function
 $y = A \ln x$

- convert units

i.e., convert $\frac{\text{Kg}}{\text{m}^3}$ to $\frac{\text{g}}{\text{mm}^3}$

- exponential calculations

$$10^x \cdot 10^y = 10^{x+y}$$

i.e., $e^x \cdot e^y = e^{x+y}$

$$(10^x)^y = 10^{xy}$$

- trigonometric functions

i.e., $y = \sin x$
 $y = \cos x$
 $y = \tan x$

