Independent Health Facilities

Clinical Practice Parameters and Facility Standards

(Revised April 2010)
The College of Physicians and Surgeons of Ontario

Vision Statement

Quality Professionals, Healthy System, Public Trust

Our Mandate

Build and maintain an effective system of self-governance.

The profession, through and with the College, has a duty to serve and protect the public interest by regulating the practice of the profession and governing in accordance with the Regulated Health Professions Act.

Our Vision Defined

Quality Professionals, Healthy System, Public Trust.

Our new vision is the framework by which we organize ourselves. It guides our thinking and actions into the future. It defines not only who we are, but what we stand for, the role we see for ourselves, our critical relationships, in what system we work, and the outcomes we seek.

Each component of our vision is defined below:

Quality Professionals – as a profession and as professionals, we recognize and acknowledge our role and responsibility in attaining at a personal, professional, and at a system-level, the best possible patient outcomes.

We are committed to developing and maintaining professional competencies, taking a leadership position on critical issues that impact the performance of the system, and actively partner to provide tools, resources, measurement, to ensure the optimal performance at all levels of the system.

Healthy System – the trust and confidence of the public and our effectiveness as professionals is influenced by the system within which we operate. Therefore, we, as caring professionals, are actively involved in the design and function of an effective system including:

- accessibility
- the interdependence of all involved
- measurements and outcomes
- continued sustainability
Public Trust – as individual doctors garner the trust of their patients, as a profession we must aim to have the trust of the public by:

- building positive relationships with individuals
- acting in the interests of patients and communities
- advocating for our patients and a quality system

Our Guiding Principles

*Integrity, accountability, leadership and cooperation.*

The public, through legislation, has empowered the profession to regulate itself through the College.

Central to the practice of medicine is the physician-patient relationship and the support of healthy communities. As the physician has responsibility to the patient, the profession has the responsibility to serve the public through the health-care system.

To fulfill our vision of quality professionals, healthy system, public trust we will work to enhance the health of the public guided by professional competence and the following principles:

**Integrity** – in what we do and how we go about fulfilling our core mandate:

- coherent alignment of goals, behaviours and outcomes;
- steadfast adherence to a high ethical standard.

**Accountability to the public and profession** – we will achieve this through:

- an attitude of service;
- accepting responsibility;
- transparency of process;
- dedicated to improvement.

**Leadership** – leading by proactively regulating our profession, managing risk and serving the public.

**Cooperation** – seeking out and working with our partners – other health-care institutions, associations and medical schools, etc. – to ensure collaborative commitment, focus and shared resources for the common good of the profession and public.
Independent Health Facilities

Clinical Practice Parameters and Facility Standards

(Revised April 2010)
First Edition, January 2003:

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Preface

The Independent Health Facilities Act (IHFA), proclaimed in April 1990, and amended in 1996 and 1998, gives the College of Physicians and Surgeons of Ontario the primary responsibility for carrying out quality assessments in Independent Health Facilities. These out-of-hospital facilities may provide some of the following insured services:

- in diagnostic facilities: radiology, ultrasound, magnetic resonance imaging, computed tomography, nuclear medicine, pulmonary function, and sleep studies
- in treatment or surgical facilities: one or more of a variety of procedures in peripheral vascular disease, plastic surgery, obstetrics and gynaecology, dermatology, nephrology, ophthalmology, and their related anaesthetic services and perhaps other specialties.

The College of Physicians and Surgeons of Ontario has a legislative mandate under the Act to perform quality assessment and inspection functions. This responsibility, and others set out by agreement with the Ministry of Health and Long-Term Care, contribute to the College achieving its goals as stated in the College’s Mission Statement. An important goal of the College is to promote activities which will improve the level of quality of care by the majority of physicians. The Independent Health Facilities program helps reach this goal by developing and implementing explicit clinical practice parameters and facility standards for the delivery of medical services in Ontario, assessing the quality of care provided to patients, and as a result, promotes continuous quality improvement.

Purpose of Clinical Practice Parameters

The Independent Health Facilities clinical practice parameters and facility standards are designed to assist physicians in their clinical decision-making by providing a framework for assessing and treating clinical conditions commonly cared for by a variety of specialties. The primary purpose of this document is to assist physicians in developing their own quality management program and act as a guide for assessing the quality of patient care provided in the facilities.

Note: The parameters and standards are not intended to either replace a physician’s clinical judgement or to establish a protocol for all patients with a particular condition. It is understood that some patients will not fit the clinical conditions contemplated by certain parameters and that a particular parameter will rarely be the only appropriate approach to a patient’s condition.

In developing these clinical practice parameters, the objective is to create a range of appropriate options for given clinical situations, based on the available research data and the best professional consensus. The product, therefore, should not be thought of as being “cast in stone”, but rather subject to individual, clinically significant patient differences.
Role of the College of Physicians and Surgeons

At the beginning of this process, the College adopted the role of a facilitator for the development of clinical practice parameters and facility standards. Representatives of national specialty societies and sections of the Ontario Medical Association, and individuals with acknowledged skill, experience and expertise formed specialty-specific Task Forces.

The Task Force members’ initial work, distributed in March 1991, was sent to the following organizations for their review and comments:

- all relevant specialty physicians in Ontario, national specialty societies and specialty sections of the Ontario Medical Association
- Ontario Chapter of the College of Family Physicians of Canada
- Canadian Medical Association
- American Medical Association
- Canadian Council on Health Facilities Accreditation (Currently renamed the Canadian Council on Health Services Accreditation)
- College of Nurses of Ontario

The Task Forces continue to adhere to the following principles:

- clinical practice parameters must be based on the appropriate mix of current, scientifically-reliable information from research literature, clinical experience and professional consensus.
- any parameter-setting exercise must be done exclusively from the quality perspective. That may well mean that some of the conclusions reached could add to medical care costs.
- parameters have to be flexible enough to allow for a range of appropriate options and need to take into account the variations in practice realities from urban to rural areas.
- parameters need to be developed by consensus and consultation with the profession at large.
- parameters should provide support and assistance to physicians without boxing them in with “cookbook formulas.”
- parameters will need to be regularly updated based on appropriate research studies.
- parameters should reduce uncertainty for physicians and improve their clinical decision-making.
- information on practice parameters must be widely distributed to ensure that all physicians benefit from this knowledge.
Responsibilities of the College

Responsibilities of the College include:

- assessing the quality of care when requested by the Ministry. The College will maintain a roster of physicians, nurses, technologists and others to serve as inspectors and assessors as required.
- inspecting the illegal charging of facility fees by unlicensed facilities when requested by the Ministry.
- monitoring service results in facilities. The College’s information system will monitor individual and facility outcome performance. This is a unique feature of the legislation, which for the first time in North America, requires facility operators to establish and maintain a system to ensure the monitoring of the results of the service or services provided in a facility.
- providing education and assisting facilities so that they may continually improve the services they provide to patients. The College will work with and assist physicians in these facilities so that they can develop their own quality management programs based on the parameters and standards, monitor facility performance by conducting quality assessments, work with facilities to continually improve patient services, assist in resolving issues and conducting reassessments as necessary.

Updating this Document

These parameters and standards are subject to periodic review, and amendments in the form of replacement pages may be issued from time to time. Such pages will be mailed automatically to all relevant independent health facilities. It is planned to issue new editions of the parameters and standards at intervals not greater than five years. The external review process will be repeated to validate the new parameters as they are developed.

Radiology Guiding Principles

Extracted from the first edition (February 1995) of Clinical Practice Parameters and Facility Standards for Diagnostic Imaging,

A diagnostic imaging practice is a consultative physician service rendered by qualified specialists who have completed an accredited residency program in diagnostic radiology which includes using all modalities in the imaging portrayal of human morphology and physiological principles in medical diagnosis.
The elements of radiologic consultation include:

- pre-examination evaluation by a referring physician.
- a request for radiologic consultation. The requisition includes pertinent clinical findings, a working diagnosis, and signature of referring physician or other qualified professional.
- a safe patient environment in which the radiologist supervises a qualified staff whose efforts are directed at producing a radiologic examination yielding maximum diagnostic information and consistent with the least possible exposure to radiation.

Diagnostic imaging is a patient care specialty and it is an important function of the radiologist to advise referring physicians about the best sequence of examinations for resolving a clinical problem expeditiously and with the least risk and cost.

It is not possible to establish a “minimum” or “optimum” standard of care. Guiding principles and attributes for appropriate care in diagnostic imaging can be summarized as follows:

- examinations and procedures are performed with the greatest benefit and least risk to the patient.
- examinations and procedures are interpreted with the highest degree of competence using all available information including comparison with previous examinations and procedures.
- examination/procedure findings and conclusions are communicated promptly and expeditiously to the referring physician.
- referring physicians are consulted in order to select and perform only the most useful examinations/procedures.
- flow of data including storage, retrieval, and general handling of images, diagnostic data, and reports are managed efficiently.
- patient services provided are considerate of the human side of care as well as the purely technical component of care.
- patient services are managed so that productivity is maintained and optimal use of available resources is assured.

These principles should constitute the basis for the evaluation of desirable and undesirable practice patterns.
Independent Health Facilities
Clinical Practice Parameters and Facility Standards:

Magnetic Resonance Imaging

VOLUME 1
Facility Standards

THE COLLEGE OF PHYSICIANS & SURGEONS OF ONTARIO
Chapter 1  Staffing a Facility

Overview

Diagnostic imaging services are provided by qualified imaging physicians and technologists.

There is a current written plan describing the organization of the facility and its services.

There are sufficient numbers of qualified physicians, technologists, and clerical personnel available to meet the stated goals and objectives. Duties and responsibilities of all diagnostic imaging services staff are specified in job descriptions.

Staff are educated in Workplace Hazardous Materials Information System (WHMIS) and this is documented.

A radiologist or designated physician with current Advanced Cardiac Life Support (ACLS) certification is personally and immediately available. Documentation regarding ACLS certification is maintained on site.

At least one staff member with current Basic Cardiac Life Support (BCLS) certification is on site at all times during hours of scanner operation. Documentation regarding BCLS certification is maintained on site.

Qualifications of Physicians

Physicians performing or interpreting Magnetic Resonance Imaging (MRI) examinations are:

- certified in Diagnostic Radiology with the Royal College of Physicians and Surgeons of Canada and have a certificate of registration to practice in Ontario.

  OR

- formally recognized as a specialist in Diagnostic Imaging by the College of Physicians and Surgeons of Ontario, based on the “Recognition of Non-Family Medicine Specialists” policy. Documentation must be available to demonstrate full compliance with any terms, condition or limitations of their registration with the CPSO, including any supervision requirement or scope of practice definition.

  AND

- have demonstrated competence (6 months of MRI training, 1500 reported cases) in an appropriate facility and under the full-time supervision of a radiologist fully trained in MRI as per the description of an MRI Director.
Appropriate training centres for radiologists seeking to obtain the required MRI credentials are:

- an academic centre with a diagnostic radiology residency program OR
- a hospital MRI facility in Canada under the supervision of the MRI Director.

**Note:** Where training occurs at a hospital MRI centre not associated with a University centre, the training should also include at least 160 hours of training through ACCME, RCPSC-recognized CME courses or equivalent (a full range of MRI clinical applications as well as MRI physics, instrumentation, QA and safety) within 2 years prior to start of practice.

In addition, the MRI Radiologist should have at least two years experience interpreting Computed Tomography (CT).

A letter signed by the MRI Director attesting to the training of all MRI Radiologists, including the Director, will be required. This letter should be kept on file at the facility.

**Note:** For the following, “MRI Radiologist” means a radiologist satisfying the above criteria.

MRI Radiologists who have not been in active practice of MRI (i.e. performing less than 100 patient cases/year) or who have not actively provided MRI services for two years or more but were fully trained in the past will require re-training at an appropriate MRI facility as described earlier in this section. A minimum of one month of re-training at an appropriate MRI facility will include reporting a minimum 300 patient cases, with an appropriate case mix, under the direct supervision of a qualified MRI Director-level radiologist. A letter from the preceptor, attesting to competence, must be presented to the MRI Director and kept on file by the licensed facility.

MRI Radiologists who have not been in active practice of CT (i.e. performing less than 100 patient cases/year) or who have not actively provided CT services for two years or more but were fully trained in the past will require re-training. A minimum of one month re-training at an appropriate CT facility will include reporting a minimum 300 patient cases, with an appropriate case mix, under the direct supervision of a qualified CT Director-level radiologist. Re-training is documented.

Under certain very specific situations, it may be appropriate for a highly specialized organ system based radiologist to interpret MRI(CT) studies limited to their sub-specialty despite not obtaining the minimum number of cases described above. Examples of this include Breast MRI or Abdominal/Body imaging. In this situation, training and limitations should be documented and approved by the MRI(CT) director and the MRI(CT) cases interpreted should be limited to the area of expertise.

All physicians attend Continuing Medical Education (CME) programs relevant to their practice, which comply with their Royal College requirements for maintenance of certification. Documentation of annual CME in MRI-related courses taken by every
radiologist providing MRI medical services must be submitted to the MRI Director no later than the end of each calendar year.

**MRI Director/Quality Advisor**

Each licensed facility has an MRI Radiologist who is appointed as both the MRI Director and Quality Advisor. The MRI Director/Quality Advisor shall have demonstrated competence (one year of MRI training) and would be qualified to provide additional on-site training to the other MRI radiologists in the licensed facility.

As outlined in the IHF Regulations “Every licensee shall appoint a Quality Advisor to advise the licensee with respect to the quality and standards of services provided in the independent health facility.”

Every MRI Director/Quality Advisor shall:

- have an active role with management staff in decisions concerning equipment purchases and disposable purchases if applicable, taken by the licensee.
- be responsible for the development and maintenance of a procedure to ensure that only services which are indicated and medically appropriate are provided (*see Preface: Radiology Guiding Principles*).
- be physically present at the Independent Health Facility on a regular basis, on average at least 8 hours per week. The MRI Director or a designated MRI Radiologist should be available by phone for consultation at any time when services are provided and documented.
- seek advice from other health professionals where necessary to ensure that all aspects of the services provided through the independent health facility are provided in accordance with generally accepted professional and quality standards.
- consult with the Quality Advisory Committee at least quarterly if the independent health facility has more than six full-time staff equivalents even if there is another Quality Advisor for other imaging modalities, otherwise at least semi-annually, and to document the substance of the discussion, the actions agreed upon, and the completion date for any actions agreed upon.
- ensure that safe MR practice guidelines are established and maintained as current and appropriate for the facility.
- consult with the facility staff after any serious MR safety incidents and, as a minimum, update the MR safety guidelines on a yearly basis.
- approve and review all MR imaging protocols performed by the licensed facility at least annually, or as often as may be deemed necessary by the MRI Director. All requisitions will be assigned a specific protocol by an MRI radiologist associated with the facility prior to the study being performed. Changes to the assigned protocol can only be modified by the MRI Director or another designated MRI Radiologist.
The MRI Director/Quality Advisor shall advise the facility licensee and document this advice concerning the following:

- qualifications, selection and ongoing education of the professional and technical staff working in the independent health facility.
- performance of any professional or technical staff who do not have sufficient qualifications for the procedures being performed but who are being permitted to practise because of special circumstances.
- whether adequate and appropriate staffing, equipment and procedures are available to ensure patient and staff safety in the independent health facility, particularly with respect to the use of equipment containing ferrous materials and/or electronics in the vicinity of the MRI scanner.
- whether a physician or other practitioner should be physically present for the performance of any category of procedure.
- testing being performed on a periodic basis to ensure the accuracy and reliability of the independent health facility’s equipment.
- implementation and adherence to the facility’s safe MR practice guidelines.
- proper design of consultation requests, performance protocols (including, where appropriate, reference values for procedures), documentation and reports used at the independent health facility.
- facility’s policies regarding the maintenance of all appropriate clinical records, including their maintenance for the required length of time.
- facility policies that are consistent with government regulations regarding the confidentiality and handling of patient information particularly if the information is being shared and stored in an electronic format.
- quality and the maintenance of the imaging equipment and the related technology for the electronic viewing, archiving, and communication of imaging information produced or in the responsible possession of the facility.
- development and maintenance of a quality assurance program for the facility.
- other such matters as deemed by the MRI Director/Quality Advisor to be important to the maintenance of quality assurance practices that are consistent with those observed in hospital MRI facilities as well as with quality standards and international accreditation guidelines by recognized bodies such as the Canadian Association of Radiologists and the American College of Radiologists.

Every licensee shall have a written agreement with the MRI Director/Quality Advisor requiring and authorizing the MRI Director/Quality Advisor to fulfill the requirements as set out above.

Whenever the MRI Director/Quality Advisor has reasonable grounds to believe the conduct of the diagnostic imaging services might jeopardize the safety of patients or the proper performance and interpretation of diagnostic imaging services and where, in the
judgment of the MRI Director/Quality Advisor, he or she is constrained from correcting the perceived deficiencies by actions taken or not taken by the licensee, then the MRI Director/Quality Advisor reports those concerns in writing to the Director, Independent Health Facilities as required by the Regulations under the Independent Health Facilities Act.

It is understood that the sections above do not in any manner remove from the licensee or impose upon the MRI Director/Quality Advisor the obligation or responsibility for operating the facility; it being understood that the MRI Director/Quality Advisor’s sole responsibility is to provide advice to the licensee on the matters specified.

**Medical Physicist**

A medical physicist has the responsibility for the initial acceptance testing of equipment and related systems/components and for implementing and overseeing quality control testing of the MRI scanner. The medical physicist repeats the acceptance test after any major hardware upgrades or major service incidents and failures *(see Chapter 2, Quality Control)*.

The medical physicist must either be board certified in Diagnostic Radiology by the Canadian College of Physicists in Medicine, the American Board of Radiology, or the American Board of Medical Physics and have specific training and experience in MRI; or have a PhD in Nuclear Magnetic Resonance/Magnetic Resonance Imaging plus 3 years clinical MR experience. Training and experience includes detailed knowledge of MRI physics, dose, system components and performance, safety procedures, acceptance testing, and quality control testing.

The medical physicist acquires Continuing Medical Education (CME) credits on a yearly basis relevant to their practice that complies with Board requirements for continued certification.

**Medical Radiation Technologists MRT(M.R)**

In Ontario, Medical Radiation Technologists (MRTs) are self-regulated professionals. They must practice in accordance with the applicable provincial legislation, the Medical Radiation Technology Act and the College of Medical Radiation Technologists of Ontario (CMRTO) standards of practice.

Medical Radiation Technologists have a current and valid certificate of registration with the College of Medical Radiation Technologists of Ontario in the specialty of magnetic resonance imaging. Certification in MRI must be documented.

All technologists must maintain and document current Basic Cardiac Life Support (BCLS) certification.
**Continuing Medical Education**

Medical Radiation Technologists attend and document their attendance at relevant continuing medical education programs, as mandated by the CMRTO, or as identified by the MRI Director. This documentation must be provided to the MRI Director annually no later than at the end of the calendar year.

**Charge Technologist Qualifications**

The designation of a Charge Technologist is mandatory. Their qualifications must include:

- current and valid certificate of registration with the College of Medical Radiation Technologists of Ontario (CMRTO) in the specialty of magnetic resonance imaging.
- should have 4 years full-time MRI experience.
- certificate in BCLS with recertification yearly.

Charge Technologists have completed an injection course and are certified by a Radiologist as per facility policy.

**Charge Technologist Responsibilities**

The Charge Technologist is current with changing technical trends in MRI by attending conferences, meetings, or other CME, and reading current relevant literature.

Documentation of CME is maintained.

Charge Technologists are responsible for the day-to-day operation of the MRI suite, including:

- training of all technologists to include Quality Control, MRI safety, injections, policies and procedures
- reporting to/advising the MRI Director/Quality Advisor
- ensuring that all technologists remain current with all qualifications and CME requirements
- ensuring that all support staff receive and implement MRI safety guidelines
- inputting site-specific protocols into the MRI unit
- writing and updating MRI policy and procedure manual on at least an annual basis
- ensuring implementation of policies and procedures
- maintaining records of equipment calibration, maintenance, and repair procedures
- maintaining copies of test observations and reports
- ensuring that safety policies and the equipment and facilities necessary for their implementation are in place and in working order
- implementing infection control measures
- maintaining all necessary facility supplies
- performing and documenting Quality Control procedures.

**Injection Certification**

The Charge Technologist is responsible for supervising the technologists for injection certification. The MRI Director/Quality Advisor certifies the technologist. Certification includes the following:

- successful completion of a certified program for the injection of contrast media.
- Review of all policies with the candidate regarding the injection of contrast media (patient consent, contraindications, contrast reaction protocol, premedication, radiologist availability, sterile technique, contrast protocols and facility standards).
- successful performance of 20 intravenous injections under the direct supervision of the MRI Charge Technologist. These will be logged and initialed by the MRI Charge Technologist.
- observation and recommendation of the candidate’s competence to inject contrast media under specific conditions by the MRI Director.
- presentation of certificate of competence to the candidate after certification by the Radiologist. This certificate is signed by the MRI Director/Quality Advisor. This certificate is kept along with a copy of proof of certification and a copy of the course curriculum.
- annual recertification for contrast injections at the discretion of the MRI Director.
Chapter 2  Facilities, Equipment and Supplies

Overview

All resuscitations are performed outside the scanner room. The biggest danger is the introduction of ferromagnetic objects into the magnet room by the responding staff and the resulting projectile motion of the ferromagnetic objects toward the centre of the magnet causing injury/death to anyone intersecting the projectile trajectory. Although it is possible to set up a complete emergency response trolley and equipment which is non-magnetic, it is almost impossible to ensure that all staff who may respond to the emergency will not carry any ferromagnetic objects into the magnet room.

Ambulance, fire or police crews who respond to an emergency call will be carrying ferromagnetic objects. For these reasons, it is imperative that the first response to a patient code inside the magnet is for the MRI technologist(s) to remove the patient from the magnet room.

Oral or sublingual anxiolytic medications may be administered in an IHF, but intravenous sedation or parenteral (e.g. intramuscular) sedation must be referred to a hospital. Patients who have received or taken any sedation or anxiolytics must be provided with safety instructions (i.e. should not drive home) prior to leaving the facility. Patients under the age of 18 requiring sedation are not examined in an IHF.

A metal detector similar to security detectors at airports is not recommended. They give a false sense of security, are ignored after a few months, cannot distinguish non-magnetic from magnetic materials, and will not detect most of the metal contraindications inside patients such as metal filings in the eye and aneurysm clips.

Facilities, Equipment and Supplies

Facilities have sufficient space to meet workload requirements and ensure the effective care and privacy of patients.

If headphones are available to patients, they must be disinfected after each use, otherwise disposable ear plugs should be offered.

An area must be provided for patients’ valuables/personal belongings to be secured/locked during procedures.

The minimum strength of the primary magnet must be 1.5 Tesla. If a second MR system is installed, the second magnet can be a whole-body open magnet. The MR system should be equipped with the appropriate gradient hardware, radio frequency hardware (receiver
channels), phased array coils, and software packages for the case mix. A power injector is strongly recommended.

For patient imaging, the MR system meets or exceeds the following specifications:

- new when installed in the facility and manufactured within 12 months prior to installation with current technology.

**Note:** The lifespan of MRI equipment is no longer than 10 years. Replacement equipment should be purchased under the same conditions as new equipment

- a clear upgrade pathway, defined to keep the technology current, will be implemented by the facility.
  - an OEM service contract will exists for its lifespan

**Note:** In recognition of changing technology standards, machines need to be upgradeable to future state-of-the-art requirements.

- the MRI scanner must pass all quality assurance tests at the time of installation as outlined by organizations such as the American Association of Physicists in Medicine (AAPM) or the American College of Radiology (ACR).

Facility monitoring equipment and procedures are appropriate to the documented patient mix and procedures.

The MR facility layout must give the MRI technologist an unimpeded view of the magnet room entrance door when seated at the operating console. Access is restricted to all areas within the 5 gauss magnetic field line of the MRI magnet. The magnet room itself usually encompasses this area.

Ideally the MRI technologist has a direct view of the patient down the bore of the magnet when seated at the operating console. If this is not the case then a closed television camera/monitor is installed to provide this view of the patient to the MRI technologist. The following non-magnetic equipment is available:

- stretcher (if scanner table is not detachable)
- wheelchair
- IV poles
- laundry hamper
- step stool

If a parent is expected to accompany and stay inside the magnet room with their child, then a non-magnetic chair is provided for inside the magnet room. All facility fire extinguishers that may be brought into the magnet room during a fire emergency are non-magnetic. The fire alarm must be audible inside the magnet room.
There should be a small, portable, strong (usually rare earth) magnet available to the MRI technologist to test whether objects are ferromagnetic. [For example, Lee Valley, product number 50K02.01]

A non-magnetic step ladder (usually aluminum) should be provided for changing light bulbs inside the MRI magnet room. This task should be performed by an individual trained in MR safety.

**Note:** The MRI magnet room usually appears intimidating to the patient. A facility design with daylight entering the magnet room decreases patients’ fears.

### Safety Concerns and Resuscitation Equipment

The facility has alternate materials available for patients with known or suspected latex allergies. (Please see Appendix V)

Facilities performing contrast-enhanced studies require the presence of a physician who is trained and experienced in the recognition and management of adverse effects of these agents (ACLS) and other life threatening events. If this physician is not the MRI Radiologist, then he/she must also have appropriate training and experience in MR safety. Technologists are trained in resuscitation (BCLS). The IHF is very different from hospital-based MRI units where experienced teams manage codes of differing severity, therefore the IHF must have an emergency protocol in place to deal with these types of emergencies.

If pediatric patients are to receive contrast then specific pediatric doses/drugs and pediatric resuscitation equipment should be clearly labelled and colour coded for age groups.

Facilities provide a means of moving patients in difficulty outside the magnet room to an area equipped to handle any adverse reactions up to and including respiratory and cardiac arrest.

Any interventions and resuscitative procedures MUST take place outside the magnet room.

No additional personnel or equipment will enter the magnet room.

### Resuscitative and Monitoring Equipment Required

Excellent guidelines, such as the Manual on Contrast Media (Contrast Media 4th Edition American College of Radiology 1998) are published, however, it is recommended that for each site a plan of action and formulary be developed in consultation with local anaesthetists and internal medicine specialists responsible for their hospital arrest teams.
Appropriate emergency equipment, as noted below and medications must be immediately available to treat adverse reactions associated with the administration of contrast media. Protocols for the contact of Emergency Medical Services (EMS) and patient transfer to a hospital should be published, posted and regularly reviewed.

The equipment includes, but is not limited to:

- ECG monitor
- defibrillator
- oxygen source with mask
- all oxygen tanks must be non-magnetic
- oxygen & suction
- MR compatible oxygen saturation monitor
- resuscitation drugs
- stethoscope
- sphygmomanometer
- IV pole
- wheelchair
- stretcher
- laryngoscope and endotracheal tubes (sized for adults)
- oropharyngeal airways (sized for adults)
- ambu bag or equivalent (sized for adults)

The contents of the resuscitation tray are checked monthly for expiry dates on all drugs and sterile equipment. These activities are documented and kept with the resuscitation equipment.

Quality Control

All equipment is properly maintained and calibrated during the monthly preventive maintenance period in accordance with manufacturer specifications. Written records of preventive maintenance, repairs, and unscheduled down time are maintained. A daily record of both the MRI magnet room and equipment room temperature, humidity, primary chilled water temperature, secondary water temperature, and the magnet helium level (where appropriate) are documented. The following Quality Control schedule is recommended:

- **Daily**: a phantom scan should be done before the first patient is scanned. A different MR coil is used every day with the appropriate manufacturer’s supplied MR phantom for that particular coil. Depending on number of days...
of operation per week, the most commonly used set of 5 to 7 coils should be rotated through for the daily Quality Control each week. Signal to Noise, Ghosting, and Geometric Distortion is measured and recorded. If available, the transmitter amplitude, receiver gain, and the MRI centre frequency is recorded.

- **Weekly**: On the day that the head coil is tested, image uniformity is measured and recorded. As well, the diffusion weighted stroke protocol used by the facility is run on the head coil phantom and the ghosting and image distortion is measured and recorded. If a hard copy camera is used a test film is printed and the optical densities of the test step pattern measured and recorded. This requires that the site have a small film densitometer. The camera internally generates the test film pattern.

- **Monthly**: depending on phantom availability, the slice profile and slice position is measured and recorded. If an appropriate phantom is not available, the accuracy of the laser beam couch positioning is checked with a MRI marker such as a vitamin E pill taped to the head coil phantom. The Radio Frequency (RF) cabin should be checked for RF leaks with an FM radio.

- **Quarterly**: the medical physicist reviews the daily Quality Control data and the system repairs log.

- **Annually**: a qualified medical MRI physicist performs the complete system acceptance test with the ACR Test Phantom.

After any service work/repairs the service engineer runs the calibrations/ service tests as appropriate for the specific hardware serviced.
Chapter 3  Developing Policies and Procedures

Overview

There are current written policies and procedures to provide diagnostic imaging staff with clear direction on the scope and limitations of their functions and responsibilities for patient care.

Developing Policies and Procedures

The procedure manual is available for consultation by all diagnostic imaging personnel.

The manual is reviewed annually, revised as necessary, and dated to indicate the time of the last review or revision.

There is documentation to indicate who makes the policies, sets the standards, and who supervises physicians, technologists, and other staff.

Procedures in the manual include, but are not limited to, the following:

- imaging protocols detailing the sequences involved in examining a target organ for both adult and paediatric patients.
- instructions regarding routine preparation of patients.
- safety of patients who have taken oral or sublingual anxiolytics particularly for patients departing the facility.
- techniques for managing patients with claustrophobia, anxiety and emotional distress.
- managing patients with possible or definite ferrous/metallic foreign bodies (particularly intracranial and intraocular locations).
- screening just prior to patient entering the magnet room.
- response to fire alarm and fire within the magnet room.
  - when personnel are present in the facility
  - when personnel are not present in the facility
- working with local emergency response teams.
- initiating a magnet quench.
- inadvertent magnet quenches.
- maintenance work inside the magnet room.
- pregnancy of patients/facility staff.
- adult sedation.
• family member/ support person in the room
• delegated acts and medical directives.
• scope and limitations of diagnostic imaging services provided by the facility.
• patient-booking systems.
• certification for administration of contrast injections.
• patient consent, written or verbal, based on the scope of practice in the facility and in accordance with the Health Care Consent Act.
• infection control.
• contradictions for performing tests.
• latex anaphylaxis
• specific first aid measures to be followed and documented in the event of an adverse health effect, including a description of the arrangements for transferring patients to an acute care facility when required.
• documentation of and method for receiving written referrals for consultation.
• methods for preliminary interpretations and/or telephone calls of reports, and for the subsequent written interpretation of images by qualified diagnostic imaging physicians.
• maintenance of requisitions, imaging media and interpretation reports (See Appendix VIII, Independent Health Facilities Act-Ontario Regulation 57/92 -Amended to O.Reg. 14/95).
• confidentiality
• safety training for medical and non-medical staff.
• emergency resuscitation both inside and outside the MRI suite.
  o emergency resuscitation only to occur outside the magnet room
• Material Safety Data Sheets (MSDS) for all chemicals maintained in the facility.
• routine maintenance and calibration of equipment.
• performance of additional views and examinations—any additional views or examinations are identified in the imaging report with reasons.

**Infection Control**

Routine practices to prevent infection: These are described in detail in the CPSO guidelines Infection Control in the Physician’s Office 2004 Edition booklet that is available for all physicians.

**At Risk Patients**

The facility must identify patients who have any possibility of transmission of infection at the front desk following the protocol proposed by Infection Control in the Physician’s
Hand Hygiene
For routine cleaning-plain soap and water or alcohol based sanitizer must be used.
For patients with diarrhoea, plain soap and water. For interventional procedures antimicrobial soap and water or alcohol based soap and water must be used.

Personal Protective Equipment
Gloves, masks, gowns and eye- protection equipment must be used where and when necessary to protect both patient and personnel.

Disposal of Sharps
All precautions must be taken to prevent injuries from sharps by following careful drawn protocols such as no recapping of needles and passing needles without injuring each other and disposal in dedicated sharp containers.

Severe Acute Respiratory Syndrome (SARS) and Other Allied Respiratory Infections
Severely Acute Respiratory Syndrome (SARS) is an acute viral (SARS- CoV, a coronavirus) infection transmitted primarily through respiratory droplets. However, transmission via airborne route or formites has not been entirely ruled out.

The greatest risk of SARS and other allied respiratory infections transmission- is exposure of health care personnel and other patients or visitors to individuals who are infected with SARS and other allied respiratory infections in a health care setting. To prevent SARS and other allied respiratory infections, all precautions must be taken as soon as patient or visitor come into a health care facility.

Each facility should implement a team and a written protocol to manage all patients with potentially infectious respiratory conditions. These are the following guidelines set for outpatient clinic settings. The following precautions against SARS and other allied respiratory infections must be followed when there is an alert of an outbreak of SARS and other allied respiratory infections.

Outpatient Settings
- Identify patients who may have infectious respiratory illness in outpatient settings, screen patients in the reception area about the presence of fever or respiratory symptoms
• Offer the patient a surgical face-mask. If possible, provide a separate waiting area where possible for patient or visitors with respiratory symptoms.

• Encourage practice of “respiratory etiquette” for patients and visitors.
  - provide surgical masks to individuals coughing, sneezing or with other respiratory symptoms.
  - provide hand hygiene products and tissues in waiting area
  - provide designated containers of disposal of used tissues.

• All personnel should wear surgical masks, or ideally, fit-testing N95 or equivalent masks when evaluating patients with suspected respiratory illnesses, and practice frequent hand hygiene.

**Privacy Policy for Physicians and Allied Health Care Workers**

The independent health facility is expected to implement the various privacy procedures and policies to maintain patient information confidentiality within the organization. The organization must respect all laws that have been enforced on it by the privacy commissioner of Canada. The patient/individual has the right to view the personal confidential information that has been gathered at the IHF from him/her. This information can only be used or disclosed for which the patient/individual has given consent.

For more information:
The Office of the Privacy Commissioner of Canada
112 Kent Street
Ottawa, ON  K1A 1H3

Telephone: (613) 995-8210  Toll Free: (1-800) 282-1376  Fax: (613) 947-6850

Web site: [www.privcom.gc.ca](http://www.privcom.gc.ca)  Email: info@privcom.gc.ca

**PIPEDA**

The independent health facility is expected to implement the various privacy procedures and policies to maintain patient information confidentiality within the organization. The organization must respect all laws that apply to it, including laws relating to privacy, confidentiality, and security of records and access to records, including the *Personal Health Information Protection Act, 2004*.

Information and Privacy Commissioner/Ontario
Suite 1400, 2 Bloor Street East
Toronto, ON  M4W 1A8
[www.ipc.on.ca](http://www.ipc.on.ca)
Overview

The content of this overview has been extracted from the CAR Guidelines on Communication (approved in June 1997; reviewed in September 2001. www.car.ca).

Communication is a critical component of the art and science of medicine and is especially important in Diagnostic Radiology. Diagnostic Radiology is one of the most important consultative services in medicine.

The final product of any consultation is the submission of a report on the results of the consultation. In addition, the diagnostic radiologist and the referring physician have many opportunities to communicate directly with each other during the course of a patient’s case management. Such communication should be encouraged because it leads to more effective and appropriate utilization of Diagnostic Radiology in addressing clinical problems and focuses attention on such concerns as radiation exposure, appropriate imaging studies, clinical efficacy, and cost-effective examinations.

These principles apply to all radiology consultations irrespective of the technology used including Picture Archiving & Communication Systems (PACS) or an equivalent electronic work station with an archival system.

In order to afford optimal care to the patient and enhance the cost-effectiveness of each diagnostic examination, radiological consultations ought to be provided and images interpreted within a known clinical setting. No screening radiological examination should be performed unless evidence-based or part of an organized population-based screening program.

The Canadian Association of Radiologists (CAR) supports radiologists who insist on clinical data with each consultation request and the IHF Task Force supports this same principle.

For teleradiology information please see Volume 3: Teleradiology (PACS).

Requesting Procedures

Written requisitions and forms to screen the patient for MRI compatibility must be completed by the referring physician. All MRI requests must be approved and prioritized by a radiologist prior to booking the test. The technologist rescreens just prior to the patient entering the magnet room. (for sample screening forms, see Appendix II)
An appropriate request for all radiological consultations is the responsibility of the referring physician and specifies:

- the basic demographic information of the patient such as name, health number, date of birth, and sex.
- the name of the referring physician and the names of any other physicians who are to receive copies of the report.
- the type of procedure requested for the patient including any special instructions where applicable.
- pertinent clinical information including indications, pertinent history, and provisional diagnosis.
- whether a “stat report” is required.

If a patient arrives with requisitions and screening form containing incomplete information the referring physician is contacted.

It is recommended that patients be provided written information about magnetic resonance imaging procedures prior to an appointment.

**Reporting Procedures**

Previous diagnostic images are available for the interpreting physician.

Reports of the interpretation of imaging procedures include the following:

- name of the patient and another identifier such as birth date, pertinent identification number.
- name of the ordering physician, most responsible physician and/or other physicians.
- name or type of examination.
- dates of examination, dictation, and transcription.
- limitations, technical factors, or patient anatomy.
- reasons for additional views or examinations if deemed necessary.
- findings using precise anatomical and radiological terminology to describe the findings accurately and a description of the procedures performed and any contrast media (agent, concentration, volume and reaction, if any), medications, catheters, devices, if not reported elsewhere.
- any pertinent clinical issues raised in the request for the imaging examination.
- comparative information with previous examinations.
- a “conclusion” section unless the study is being compared with other recent studies and no changes have occurred during the interval, or the body of the report is brief. The report should also contain:
- a precise diagnosis whenever possible
- a differential diagnosis when appropriate
- recommendations, when appropriate
- follow-up and additional diagnostic radiological studies to clarify or confirm the conclusion.

The final report is proofread carefully to avoid typographical errors, deleted words, confusing or conflicting statements.

**Note:** If this is not possible, a disclaimer statement is stated on the report that the report has not been proofread.

The report is authenticated by a radiologist, whenever possible. Electronic or rubber-stamp signature devices, instead of a written signature, are acceptable if access to them is secure.

- if this is not possible, the name of the radiologist who dictated the report must appear on the report.

Reports of the interpretation of diagnostic imaging examinations are transmitted to the referring physician within 24 hours if possible.

Unusual, unexpected, or urgent findings which may require immediate case management decisions are communicated to the referring physician by the interpreting physician, or as directed by the interpreting physician.

Direct or attempted direct communication is documented.

Any discrepancy between a preliminary report and the final written report is directly communicated to the referring physician or representative.

A copy of the diagnostic image is retained as the permanent record. It is recommended that either a PACS system (or an equivalent electronic work station with an archival system) be utilized if MRAs are done routinely. If film is being utilized, it is recommended that 20 images be the maximum per film.

All images must be of sufficient quality to record permanent findings, to be used for comparison with subsequent examinations, and enable third party Radiologists to confirm the diagnosis.

- the facility must have the ability to retrieve and/or produce a copy of the image(s) within 24 hours of the request as required.

The imaging media and reports are filed using an accepted coding system which allows films and reports to be retrieved by patient identification information. Unusual and interesting examinations are maintained for educational purposes.
Chapter 5  Providing Quality Care

Overview

A Quality Advisory Committee is established as per the IHF Act. The advisory committee shall consist of health professionals who provide health services in or in connection with the independent health facility. Regular meetings are held and minutes maintained (IHF Act Regulation 57/92 amended to 14/95-see Appendix VI).

To provide quality of care, there is evidence that patients’ needs for diagnostic imaging services are assessed. The services planned and provided are consistent with those needs and assure diagnostic reliability and patient safety.

Facility staff should have meetings at least quarterly and maintain minutes.

Providing Quality Care

The performance of MRI examinations complies with standards accepted by the College of Physicians and Surgeons of Ontario as described in the Clinical Practice Parameters section.

A designated MRI Radiologist is available for consultation with the technologist on a case-by-case basis. For cases requiring monitoring, ideally, the MRI Radiologist is on-site and available to participate in the examination when required.

Although optimally a designated MRI Radiologist is present for all cases this is not always possible. For cases that do not require monitoring a designated MRI Radiologist should always be available by phone to consult with the technologist and referring physician.

Whenever contrast is administered, a designated physician must be personally and immediately available. There must be adequate equipment/medications available to treat an adverse reaction.

An MRI-trained radiologist should visit the facility on a regular basis to review imaging procedures and provide technologist supervision. Ideally there should be an MRI radiologist present at the facility on a daily basis. Even in remote sites, an MRI-trained radiologist should be on site at least one day per week. A daily log of visits to the facility by the radiologist should be maintained.

Diagnostic imaging procedures are carried out in a manner in which patient privacy is respected.
Monitoring Quality of Care

The facility establishes and maintains a system to monitor the results of the services provided.

The facility establishes a quality management program appropriate for its size, volume and types of services provided. It is recognized that quality management programs will vary depending on the facility size, scope of practice, and geographical considerations.

Each facility has written goals and objectives as part of their Quality Management Program.

Components of quality management include a review of:

- goals and objectives.
- policies and procedures.
- incidents, adverse drug reactions, complications.
- clinical data, for example, assessing the accuracy of interpretations and the appropriateness of procedures.
- Quality Control activities.
- staff performance appraisals.
- in-service education using recent patient records
- patient/referring physician surveys. Staff receive the results of such reviews.

Staff participate in planning strategies to overcome any deficiencies and to continually improve the services provided to patients.
Independent Health Facilities
Clinical Practice Parameters and Facility Standards:

Magnetic Resonance Imaging

VOLUME 2
Clinical Practice Parameters

The following Clinical Practice Parameters have been developed by the Canadian Association of Radiologists and have been adopted by the IHF MRI & CT Task Force, College of Physicians and Surgeons of Ontario.

All Clinical Practice Parameters contained within this document should be read in conjunction with the Facility Standards (Volume 1) developed by the IHF Task Force.
Position Statement from the IHF Radiology Task Force

The new clinical practice parameters and standards have included the original Canadian Association of Radiology (CAR) MRI standards. The reason for this is that as of this date there are no current CAR standards. Should they become available before the next review of this document these standards should form the new standard.
CAR Standards for Magnetic Resonance Imaging

Approved: June 1999

These Standards were reviewed by the Magnetic Resonance Imaging Expert Advisory Panel: Pierre Bourgouin, MD, Chair, John Mayo, MD, Blake McCarthy, MD, Pierre Milette, MD, Peter Poon, MD

The standards of the Canadian Association of Radiologists (CAR) are not rules, but are guidelines that attempt to define principles of practice that should generally produce radiological care. The physician and medical high-quality physicist may modify an existing standard as determined by the individual patient and available resources. Adherence to CAR standards will not assure a successful outcome in every situation. The standards should not be deemed inclusive of all proper methods of care or exclusive of other methods of care reasonably directed to obtaining the same results. The standards are not intended to establish a legal standard of care or conduct, and deviation from a standard does not, in and of itself, indicate or imply that such medical practice is below an acceptable level of care. The ultimate judgment regarding the propriety of any specific procedure or course of conduct must be made by the physician and medical physicist in light of all circumstances presented by the individual situation.

CAR Website Url: www.car.ca

I. INTRODUCTION AND DEFINITION

Magnetic resonance imaging (MRI) is a cross sectional imaging method based on an interaction between radiofrequency (RF) electromagnetic fields and certain nuclei in the body (usually hydrogen nuclei) after the body has been placed in a strong magnetic field. MRI provides excellent differentiation of normal tissues and exceptional sensitivity to disease. This sensitivity is based on the high degree of inherent contrast due to variations in the magnetic relaxation properties of different tissues, both normal and diseased, and the dependence of the MR signal on these tissue properties.

Magnetic resonance angiography (MRA) involves the use of selected MRI pulse sequences in order to visualize blood vessels. Functional magnetic resonance imaging (fMRI) uses powerful gradients in order to study diffusion (diffusion weighted MRI), perfusion (perfusion weighted MRI), and brain activation during pre-defined tasks (brain mapping).

This document is an updated version of the standards (first published in 1994) for the use of MRI, for the qualifications of personnel involved in the clinical application of MRI, and for quality assurance practices in MRI. The CAR Subcommittee on MRI Standards, of the CAR Task force on Radiology Standards was formed to recommend standards for the utilization of MRI for clinical diagnosis in fixed and mobile sites. It is recognized that by circumstance the available technology at individual MRI sites in Canada will vary and that the submitted standards act a guidelines for MRI practice, to which individual centers should attempt to aspire.
II. QUALIFICATIONS OF PERSONNEL

A. The Radiologist (for Ontario guidelines, see Volume I, Chapter 1, Staffing a Facility)

That physicians involved in the performance, supervision and interpretation of magnetic resonance imaging should be Diagnostic Radiologists and must have a Fellowship or Certification in Diagnostic Radiology with the Royal College of Physicians of Canada and/or the Collège des médecins du Québec. Also acceptable are foreign Specialist qualification if the Radiologist so qualified holds an appointment in Radiology with a Canadian University.

As new imaging modalities and interventional techniques are developed additional clinical training, under supervision and with proper documentation, should be obtained before radiologists interpret or perform such examinations or procedures independently. Such additional training must meet with pertinent provincial/regional regulations. Continuing professional development must meet with the requirements of the Maintenance of Certification Program of the Royal College of Physicians and Surgeons of Canada.

B. Medical Physicists (for Ontario guidelines, see Volume I, Chapter 1, Staffing a Facility)

A medical physicist (on-site or contracted part-time) shall have the responsibility for the initial acceptance testing and for conducting and overseeing quality control testing of the MR scanner.

The medical physicist shall be certified by the Canadian College of Physicists in Medicine and shall have specific training and experience in MRI. Training and experience shall include detailed knowledge of the physics of MRI, system components and performance, safety procedures, acceptance testing, and quality control testing.

C. MR Technologists (for Ontario guidelines, see Volume I, Chapter 1, Staffing a Facility)

The medical radiation technologist must have Canadian Association of Medical Radiation Technologists (CAMRT) certification in magnetic resonance (RTMR) or be certified by an equivalent licensing body recognized by the CAMRT.

Under the overall supervision of the radiologists, the technologist is responsible for patient comfort and safety, examination and preparation of patients, performing the MRI scans, technical and quality evaluation of images and relevant quality assurance.

Continued education of technologists is encouraged by the C.A.M.R.T. and should meet pertinent provincial regulations.

D. Service Engineers
The service engineer shall be responsible for system installation, calibration, and preventive maintenance at regularly scheduled intervals. The service engineer's qualification will be ensured by the corporation responsible for service and the manufacturer of the MR equipment used at the site.

III. CONTRAINDICATIONS

Contraindications include, but are not limited to, the presence of cardiac pacemakers, ferromagnetic heart valves, ferromagnetic intracranial aneurysm clips, neuro stimulators, certain otic implants and ferromagnetic foreign bodies in critical locations, e.g., the eye. Relative contraindications include claustrophobia and obesity.

The safety of MR scanning during pregnancy has not been established. The decision to scan during pregnancy should be made on an individual basis after consideration of medical necessity and alternate imaging methods. This particularly applies to scanning during the first trimester.

IV. TECHNIQUES

The committee has attempted to enumerate the currently accepted techniques for MRI based on clinical experience, as summarized in peer-reviewed literature. Because the clinical application of MRI is still under development, it is not intended that the enumerated techniques (and indications in the reference document) be all-inclusive. It is very important that each site offering MRI have documented procedures for the indications and technical factors for each anatomic site.

These procedures will need to be reviewed frequently. The final judgment regarding appropriateness of a given examination for a particular patient is the responsibility of the radiologist.

The indications for scanning could include any part of the human body, depending on the MR software and hardware available and the efficacy and availability of competing imaging methods.

To accomplish its clinical purposes, MRI must be performed with adequate attention to technical abilities of the MR scanner.

Spatial resolution, slice thickness, signal-to-noise (SNR), and acquisition time are all inter-related sequence parameters which have a major influence on the detect-ability of disease. In the performance of any MR examination, major decisions have to be made regarding the appropriate coil, the imaging plane(s), the field of view (FOV), the slice thickness and slice gap, the imaging matrix, the number of excitations, the requirement for ECG gating and respiratory compensation, band width selection, the pulse sequence parameters which maximize signal and contrast to noise and contrast needs.

The purpose of these guidelines is not to prescribe the details of individual techniques, but rather to address the spectrum of recognized MR applications and to outline the minimum requirements necessary to undertake these, and to which the radiologist, in conjunction with ancillary staff should aspire.
Techniques and references are presented by anatomic site.

V. CHOICE OF AN MR SYSTEM

Many systems are available on the market with different field and gradient strengths. In addition, closed and open configuration are offered. Purchase of a system is subject to financial and site considerations. Knowledge of the referral base and clinical needs is also necessary and will help choose the appropriate system. Before purchasing a system, it is recommended that a team be set up which will include a radiologist with previous MR experience, a medical physicist with previous MR experience, technologists and administrators. [Please refer to the Facilities, Equipment and Supplies section in the Facility Standards]

VI. PRINCIPLES OF CONTRAST AGENT USE

There are many potential indications for injection of contrast agents:

A. When breakdown of the blood-brain barrier is suspected, the intravenous administration of gadolinium chelates may increase the sensitivity of magnetic resonance imaging in the central nervous system.

B. When characterizing the vascularity of pathology outside of the central nervous system, or when improved lesion conspicuity is achievable due to differential vascularity and subsequent enhancement.

C. For visualizing vessels both in the central nervous system and outside the central nervous system.

D. For performing perfusion studies.

E. New contrast agents for use in the liver, pancreas or bowel loops or for blood pool are or will be available in the next few years.

In general, with many applications (gadolinium chelates), it is desirable to acquire T1-weighted images (either spin echo (SE) or gradient echo (GE)) using the same technique both before and after the administration of gadolinium chelates. (When images are acquired only after administration of gadolinium chelates, it may be difficult to distinguish other causes of high signal intensity, i.e., extracellular methemoglobin from subacute hemorrhage, flow related enhancement from inflowing blood orCSF, or fatty lesions, from gadolinium-enhancement.) In practice, a pre-injection T1-weighted image in a single plane is generally adequate for comparison. It is often useful to obtain fat saturated T1-Weighted images to better visualize gadolinium enhancement at sites where there is a lot of fat (e.g. orbits, base of skull, pelvis, etc.).

Gadolinium chelates should not be administered to patients with known or suspected hypersensitivity to the product or with severe hepatic insufficiency.
VII. RECOGNIZED CLINICAL APPLICATIONS OF MR

A. Adult and Pediatric Brain

B. Adult and Pediatric Spine

C. Head and Neck

D. Abdomen and Pelvis (Male and Female Genitourinary System)

E. Musculoskeletal System

F. Cardiac

G. Chest

H. Vascular and Magnetic Resonance Angiography

I. Breast Imaging

A. Brain

In both the adult and pediatric brain, magnetic resonance imaging is more sensitive than x-ray computed tomography for the detection of parenchymal abnormalities in the brain (1). This is particularly true in the posterior fossa (2,3) where CT is degraded by beam-hardening, Hounsfield artifact. The advantage of MRI is based on the greater sensitivity of long TR, short TE (‘proton density (PD) weighted’ images) and long TR, long TE ‘T2-weighted images (T2WI) to alterations of water content compared to the differences in electron density seen by CT.

In infants, the water content of the brain is much higher than in adults. The excess water present in the newborn is gradually lost from both the grey and white matter during the first two years of life. In order to optimally visualize pathology and differentiate grey and white matter on T2W images during this time period it is often useful to prolong the TE and TR values. TR times of 3000 msec or more and TE times of 120 msec or more are useful. It is also useful to obtain axial TIW sequences. This may be helpful to more fully evaluate for possible congenital disorders of migration which demonstrate abnormalities of the sulci and gyri and to be used in conjunction with T2W images to evaluate myelin deposition.

The minimum standard MR technique for scanning the brain should endeavour to maximization SNR and spatial resolution and should include the following:

1. A dedicated head coil should be used for imaging.
2. Imaging in at least two separate planes.
3. T1-weighted images are usually obtained in the sagittal plane together with axial T2-weighted images in the axial plane. In addition, routine examinations might include axial T1-weighted, proton density-weighted or flair images. Conventional or fast spin echo pulse sequences can be used. The choice of pulse sequences should be tailored to the clinical indication of the study (e.g. multiple...
sclerosis, IAC's, pituitary fossa).

4. Slice thickness of no greater than 5 mm provided that current technology with user-defined bandwidth selection is available. With older technology, slice thickness of at most 6 mm can be tolerated.

5. Slice gap between 20 and 50%.

6. Matrix and slice profile selection resulting in an in plane spatial resolution in the order of 1 mm.

7. Maximum use of motion and flow artifact reduction techniques; i.e. first order flow compensation.

8. Gadolinium-enhanced studies are performed when lesion diagnosis and improved conspicuity are required. If flow compensation is available, it has been found to be useful in the evaluation of gadolinium-enhanced images in the posterior fossa which are otherwise degraded by flow artifacts arising from the transverse and sigmoid sinuses.

The exact combination of repetition time TR and echo delay time TE to produce the desired contrast depends on field strength since TI increases with increasing field. For example, when the field strength is increased from .35 Tesla to 1.5 Tesla, the TI of the brain increases by 62%. Thus to have comparable amounts of T1-weighting (short TR) or T2 or proton density weighting (long TR), TR must be scaled to T1 at different field strengths.

New pulse sequences are now available for imaging in the brain. These include:

1. Fluid attenuated inversion recovery (FLAIR) which produces T2-weighted images with dark CSF. It is particularly useful for detection of multiple sclerosis lesions.

2. Diffusion weighted pulse sequences which enable study of proton motion with the use of powerful gradients. The most common clinical indication is for detection of acute ischemic stroke.

3. Perfusion studies using bolus injection of gadolinium and rapid acquisition of multiple brain volumes. Perfusion studies are usually done to determine regional cerebral blood flow and blood volume in patients presenting with acute ischemic stroke.

B. Spine

The role of MRI in the spine has been well established by comparative studies with conventional imaging methods using surgical correlation as an objective measure of accuracy. The areas of greatest proven value include degenerative diseases involving both the cervical and lumbar spine, vertebral inflammatory lesions, congenital malformations and intramedullary lesions such as syringomyelia and neoplasms. Equally useful are the applications of MRI in evaluating extradural, intradural and extramedullary neoplasms, trauma, and patients with signs and symptoms of cord compression.

The minimum standard MR technique for imaging the spine includes the following:

1. A dedicated neck coil (either posterior alone or in combination with an anterior neck coil) for the cervical spine and a dedicated spine surface coil or phased-array surface coils for the thoracic and lumbar spines.
2. A combination of sagittal T1-weighted and T2-weighted images might be obtained. Again, protocols should be tailored to answer specific clinical questions. For example, when evaluating nerve roots, axial T1- or T2-weighted images should be added.

3. A maximum slice thickness of between 3-5 mm and 1.5-2 mm for cervical spine and corresponding nerve roots.

4. Slice gap between 20-30% for T1-weighted images, and 3050% for T2-weighted images.

5. Matrix and slice profile selection resulting is an in plane spatial resolution in the order of 1-2 mm.

6. Depending on the indication, either the combination of gradient moment nulling, cardiac gating, and saturation pulses for spin echo imaging (conventional or fast spin echo), or gradient moment nulling, with or without cardiac gating and saturation pulses for gradient echo imaging, should be used. Sagittal or axial gradient echo proton density-weighted sequences may be used as substitutes for T2-weighted sequences, especially for cervical and thoracic spinal biomechanical clinical problems.

7. Gadolinium chelates should be used in evaluation of intramedullary and leptomeningeal diseases especially in tumor involvement. Contrast should also be routinely utilized in the differentiation of scar from disk, especially in the post-operative failed back.

C. Head and Neck

The major strengths of magnetic resonance imaging (MRI) in the head and neck region include the outstanding soft tissue contrast, the multiplanar capabilities, the noninvasiveness (except for injection of gadolinium chelates). MR techniques include combination of SE, 2D and 3D GRE sequences, fat suppression or fat saturation sequences, and magnetic resonance angiography (MRA). The drawbacks include the insensitivity to calcification, degradation of the images caused by motion artifacts or by the presence of metallic dental appliances in the mouth.

Patients in whom neurological findings are present, in addition to the head and neck symptoms, require a complete examination of the brain.

The minimum standard MR technique for scanning the head and neck should endeavour to maximization SNR and spatial resolution and should include the following:

1. A dedicated head coil should be used in suprahyoid applications, a dedicated neck coil for infrahyoid applications and dedicated surface coils for the temporomandibular joint (TMJ) and globe.
2. A combination of T1-weighted and T2-weighted images in sagittal, axial and coronal planes are needed. Depending upon the pathology being evaluated, fat saturation and T2 GRE sequences should be used in addition.
3. Slice thickness of between 5-7 mm is suitable for most applications. For TMJ's and optic nerves a slice thickness of 3-4 mm should be used.
4. Slice gap between 20-30%, preferably 20%.
5. Matrix and slice profile selection resulting in an in-plane spatial resolution in the order of 3 mm.
6. Maximum use of motion and flow artifact reduction techniques; i.e. respiratory compensation and in flow pre-saturation.
7. Gadolinium-enhancement studies are performed when lesion diagnosis and improved conspicuity are required, i.e. tumor characterization, aggressive inflammatory process or vascular anomalies. Fat saturation or TIWI GRE sequences are desirable in order to optimize the additional contrast afforded whenever gadolinium chelates are utilized.

D. Abdomen and Pelvis
Adequate images of the abdomen may generally be obtained in high, mid, and low field strength systems. The precise technical factors employed may, however, vary depending on the instrument, its field strength, and the range of motion compensation techniques which are available. The points pertaining to field strength alluded to above will equally apply.

The minimum standard technique should include:

1. The body coil is suitable for most applications but when available, a phase array surface coil is preferable. However, when high spatial resolution is required specific configurations of phased-array surface coils and/or intraluminal surface coils can be used. FOV should be appropriate to the size of the abdominal or pelvic cavity.

2. TI-weighted and T2-weighted images through the upper abdomen generally should be acquired axially. Examinations in other planes may be useful to evaluate anatomy and pathology. Depending upon the pathology being evaluated fat saturation and T2 GRE sequences should be used in addition. Fast GRE breath hold techniques are useful for evaluation of hepatobiliary ducts and the arterial phase of some organs such as the pancreas. In the evaluation of the pelvis a combination of sagittal and axial sequences is often the most helpful for evaluation of lesions involving midline structure whereas a combination of coronal and axial sequences may be more helpful in fully assessing lesions of the bony structures, pelvis side walls and ovaries. For imaging the uterus, ideal planes are along the long and short axis of the corpus.

3. Slice thickness of between 7-10 mm is suitable for most applications in which the body coil is used. If phased-array coils or intraluminal coils are used, slice thickness in the order of 2-5 mm can be used.

4. Slice gap between 20-30%, preferably 20%.

5. Matrix and slice profile selection resulting in an in-plane spatial resolution in the order of 3-5 mm.

6. Maximum use of motion reduction techniques such as signal averaging techniques, respiratory ordered phase encoding, and gradient moment nulling techniques, selective fat saturation, and short TI inversion recovery (STIR) are examples of techniques which may be used in isolation or in combination to reduce motion related artifacts on abdominal MR imaging. Breath hold techniques should be used when available. In addition, a bowel movement reducing agent such as buscopan or glucagon should be used for all examinations except liver evaluation.

7. Gadolinium-enhanced studies are performed when lesion detection, characterization and improved conspicuity are required. Fat saturation or TIW GRE sequences are desirable in order to optimize the additional contrast afforded whenever gadolinium chelates are utilized. Gadolinium enhancement is
specifically important for detection and characterization of liver, pancreatic and renal lesions. It is also useful for staging endometrial and cervical carcinoma. Imaging of bile and pancreatic ducts (MRCP) should be achieved with heavily T2Weighted sequences either with a thick slab 3D technique or with a thin multislice sequence followed by reconstruction, without or with breath hold.

E. Musculoskeletal

The minimum standard MR technique for scanning musculoskeletal system should endeavour to maximization of SNR and spatial resolution and should include the following:

1. Dedicated volumetric coils should be used for as many joint and non-joint applications as possible to obtain ideal, uniform image contrast and spatial resolution and evaluation of the region of interest.
2. A combination of TIWI and T2WI images and multiple planes of section will be required in many instances. Depending upon the pathology being evaluated, fat saturation, 3D T1, T2 GRE and, fat suppressed proton density and STIR sequences are useful. The evaluation of cartilage surface will require a combination of 3D GRE and Fast 3D GRE. Use of intra-articular contrast injection is being investigated for that purpose.
3. Slice thickness of between 3-10 mm is suitable for most applications. 3D GRE images afford slice thickness of 0.7-3 mm for the evaluation of intra-articular pathology.
4. Slice gap between 0-20%, preferably contiguous.
5. Matrix and slice profile selection resulting in an in-plane spatial resolution in the order of 0.53 mm.
6. In peripheral musculoskeletal applications use of motion and flow artifact reduction techniques are dependent upon the anatomic region being evaluated; i.e. respiratory compensation in shoulder imaging.
7. The use of gadolinium chelates for enhancement permits more specific detection, characterization, and staging of musculoskeletal masses, and their recurrence. Gadolinium also has a role in the evaluation of inflammatory disorders. Finally intraarticular injection is being investigated, particularly following previous surgery, in the presence of joint instability, and in the assessment of certain types of joint derangement.
8. Use of vitamin E capsules is recommended to locate subtle soft tissue masses in order to confirm that the examination has included the relevant area of clinical concern.

F. Cardiovascular

There are a variety of techniques now available for MRI of the cardiovascular system. These are used in varied combinations depending upon the indication for the scan. MR studies of the heart and great vessels have usually required either prospective or retrospective cardiac gating. Evaluation of the heart may include the following techniques:

Routine applications:

1. Multislice ECG gated technique for routine evaluation of the heart.
2. Multiphasic multislice technique for the evaluation of cardiac dimensions and
function.

3. The biphasic technique is performed by acquiring images at multiple anatomical locations at end diastole and end systole.

4. Fast GRE sequences ("turbo-GRE") have made it possible to acquire images of the heart without gating, and for some special sequences (segmental turbo GRE) during a single breath-hold. The value of this technique is currently limited but it may have increasing value as a method to evaluate myocardial perfusion by monitoring the first pass distribution of MR contrast media.

5. Echoplanar (EPI) imaging provides multiple images during a single cycle without the necessity for ECG gating in an acquisition tie of 30 to 50 msec. It is expected that the fast MR techniques will undergo considerable development in the next few years.

6. Cine MR imaging can be accomplished by ECG referencing of repetitive GRE sequences. These images are laced together in a cinematic display so wall motion of the ventricles, valve motion, and blood flow patterns in the heart and great vessels can be visualized.

7. Flow-sensitive imaging techniques now permit the measurement of blood flow expressed either as velocity or volume flow per unit time. See H. Vascular/Magnetic Resonance Angiography (MRA).

The minimum standard MR technique for scanning the central cardiovascular system should endeavour to maximization SNR and fidelity of anatomic registration and should include the following:

1. In adult cardiac applications the body coil is suitable. The selected FOV should be appropriate to the size of the thoracic cavity. For pediatric applications, volumetric coils appropriate to the child size and age should be used.

2. The relative weighting in a given image is governed by the RR interval. Relatively TIWI or PD images in a combination of transverse, axial and coronal planes and oblique planes are suitable when evaluating cardiac anatomy, i.e. congenital heart disease.

3. When alternate cardiac and pericardial pathologies are under evaluation TIWI and T2WI in a combination of transverse, axial and coronal planes are acquired. Additional planes may be required in certain instances.

4. Slice thickness of between 5-10 mm is suitable for most applications.

5. Slice gap between 20-30%, preferably 20%.

6. Matrix and slice profile selection resulting in an in-plane spatial resolution in the order of 3-5 mm.

7. Optimized cardiac gating and respiratory ordered phase encoding motion reduction techniques should be employed.

8. The role of gadolinium chelates for the evaluation of ischemic heart disease has yet to be determined.

G. Chest

MRI is presently used as a problem solving modality. The principle applications are evaluation of the chest wall, mediastinal and hilar structure. All other pertinent imaging studies should be reviewed before MRI imaging is undertaken.

The minimum standard MR technique for scanning the chest should endeavour to
maximization of SNR and fidelity of anatomic registration and should include the following:

1. In adults the body coil is suitable. The selected FOV should be appropriate to the size of the thoracic cavity. For pediatric applications, volumetric coils appropriate to the child size and age should be used.

2. For the evaluation of mediastinal and hilar structure adjacent to the heart cardiac gating is always required, with the relative weighting in a given image governed by required RR interval. Relatively T1-weighted or PD-weighted images in a combination of transverse, axial and coronal planes and oblique planes are suitable when evaluating anatomy. For evaluation of the superior mediastinum, cardiac gating is not always required, providing greater flexibility over T1 and T2 weighting.

3. When alternate mediastinal, hilar and chest wall pathologies are under evaluation T1-weighted and T2-weighted (2 RR and 3 RR) images in a combination of transverse, axial and coronal planes; additional planes may be required in certain instances. Additional sequences (e.g. STIR) maybe of value in specific instances.

4. Slice thickness of between 7-10 mm is suitable for most applications.

5. Slice gap between 20-30%, preferably 20%.

6. Matrix and slice profile selection resulting in an in-plane spatial resolution in the order of 3-5 mm. Vascular conspicuity is improved with 2 averages (2 NEX).

7. Optimized cardiac gating, respiratory ordered phase encoding motion reduction techniques and spatial pre-saturation should be employed.

8. Gadolinium chelates should be utilized in the evaluation of recurrent or post-therapy residual chest wall and mediastinal tumors.

H. Vascular/Magnetic Resonance Angiography (MRA)

One of the remarkable features of magnetic resonance imaging is the sensitivity of amplitude and phase of its signal to moving spins, a situation that applies to flowing blood. There are three major families of MRA techniques: time of flight (TOF) or inflow angiography, phase contrast (PC) angiography (related to the phase shift of the flowing proton spins) and dynamic gadolinium-enhanced (DGE) MRA. High field MR unit (1.5 Tesla) with high-speed gradient will give the best results especially for breath-hold DGE MRA.

1. TOF methods

TOF MRA imaging methods provide vascular contrast based on tagging of the longitudinal magnetization of spins flowing into a region of interest. The more common approach is the creation of vascular contrast during a single scan acquisition followed by removal of stationary tissue by image processing. If the arterial system is to be examined, an inferior (lower limb angiography) or superior (carotid angiography) saturation band must be used to eliminate venous signal. To get an adequate signal slice, acquisition must be perpendicular to flow direction.

Inflow-enhancement-based TOF angiography can be performed using a sequential two-dimensional (2D-TOF) or a three-dimensional (3D-TOF) Fourier transform. Coverage of larger anatomic area and better signal especially for low flow are obtained with 2D-TOF techniques. Better spatial resolution are given with 3D TOF
techniques but signal loss at the distal portion of the volume of interest can be observed. If 2D TOF sequence are used, an overlap of 20 to 25 % within slices must be obtained to allow quality MIP reconstruction.

2. Phase contrast

2D or 3D PC angiograms are obtained using phase difference and encoding for velocity, which will avoid flow aliasing. This technique gives a good signal especially in case of low flow (venous flow) with excellent background suppression. Flow can be analyzed in all three directions.

Limitations of this technique are:

- Use of long TE for signal sampling which will give other T2 effects that may degrade image quality,
- Image degradation from pulsatile flow,
- Signal flow aliasing if encoding is inappropriate.

3. Breath Hold DGE MRA

This technique involves the administration of a large (0.2 mmole/kg) dose of a gadolinium-chelated contrast agent during a breath-hold 3D gradient echo acquisition (20-30 seconds). This technique provides an excellent signal without motion artefact related to respiratory motion. Adequate timing of the bolus is critical to get adequate signal without venous enhancement. Better signal to noise ratio can be obtained with subtracation.

4. Clinical applications

**Cervical carotid artery**: Neck coil, 3D TOF or 2D TOF. Effective slice thickness 1.5-2.5mm.

**Intracranial carotid artery** and circle of Willis: Head coil, 1.5- .5 mm, 3D TOF or 3D PC.

**Cerebral veins**: Head coil, slice thickness 2-4mm, 2D or 3D PC.

**Aortic arch and carotid arteries**: Body coil or body phased array, DGE MRA, effective thickness 1-2mm, short acquisition time is required to avoid jugular enhancement.

**Thoracic aorta**: Body coil or body phased array. Slice thickness 3-5mm. Anatomic studies are best achieved with conventional cardiac gated spin-echo sequences. Angiography can be performed using gated 2D TOF techniques or DGE MRA. The latter gives better visualisation of slow flow dissection and aortic ulceration.

**Abdominal aorta**: Body coil or body phased array. Slice thickness 3-5mm (aneurysm) or 1-2mm (renal artery). Best results are obtained with breath hold DGE MRA, especially for renal arteries. Cine-phase contrast sequence can be used for quantification of flow in renal arteries.

**Iliac arteries**: Body coil or body phased array. Slice thickness (2-4mm). Best results are obtained with breath hold DGE MRA. 2D TOF gated sequences can be used, but images can be limited by ghost artefact and signal loss due to tortuosity.
**Femoral arteries:** Body coil or body phased array. Slice thickness 2-4 mm. 2D TOF with or without cardiac gating (required if no proximal stenosis). Better results can be obtained

**Infra popliteal arteries:** Head or knee coil. Separate study of each side is preferred. 2D TOF. Slice thickness 2mm. Cardiac gating not required

**Entire bilateral lower limb angiogram** using DGE MRA with dedicated coil are under investigation. Preliminary data are promising.

**I. Breast Imaging**
MRI is useful in investigating patients with breast prosthesis, for excluding implant rupture. Research is currently underway to define other indications.

**VIII. EQUIPMENT SPECIFICATIONS** (for Ontario guidelines, see Volume I, Chapter 2, Facilities, Equipment and Supplies)

The MR equipment specifications and performance shall meet all provincial and federal guidelines, including HPB guidelines. The guidelines include, but are not limited to, specifications of maximum static magnetic field strength, maximum rate of change of magnetic field strength (dB/dt), maximum radiofrequency power deposition (specific absorption rate), and maximum auditory noise levels.

It is recommended that purchase and upgrade specifications be written by the medical physicist in consultation with the supervising physician and MR technologist.

**IX. SPECIFICATIONS OF THE EXAMINATION** (for Ontario guidelines, see Volume I, Chapter 2, Facilities, Equipment and Supplies)

The examination shall be performed within current HPB guidelines. When necessary, contrast and sedation shall be administered in accordance with institutional policy and provincial and federal law by a physician, who has trained in cardiopulmonary resuscitation. An appropriately equipped emergency cart must be immediately available to treat serious adverse reactions.

MR compatible ventilators, and appropriate patient monitoring should be available at those sites undertaking general anesthesia and sedation studies.

**X. SAFETY GUIDELINES** (for Ontario guidelines, see Volume I, Chapter 2, Facilities, Equipment and Supplies)

Safety guidelines, practices, and policies shall be written, enforced, documented, and reviewed at least annually by the supervising radiologist and the MR charge technologist. These guidelines take into consideration potential interactions of the magnetic field with ferromagnetic objects in the environment of the scanner. They also consider potential hazards engendered by objects implanted within the patient as well as within personnel in the area.

**XI. QUALITY CONTROL PROGRAM** (for Ontario guidelines, see Volume I, Chapter 2, Facilities, Equipment and Supplies)
The objective of an MR quality control (QC) program is to provide a series of tests and measurements which may be performed on a regular basis to determine if the MR system is performing in a reproducible and predictable manner. Protocols for routine system performance testing are still evolving. Quality control test should be conducted under the supervision of the medical physicist (if present on site), with review at least every six months by the supervising radiologist. A preventive maintenance program is recommended as a mean to minimize unscheduled down time.

A quality control program with written procedures and logs shall be maintained at the MR site.

The ongoing quality control program assesses relative changes in system performance as determined by a technologist and medical physicist (if present on site).

A. Technologist Quality Control Tests
The following quality control tests shall be performed and documented by an MR technologist knowledgeable in quality control procedures at the frequencies indicated in parenthesis:

1. measurement of central frequency (daily)
2. measurement of system signal-to-noise ratio on a standard head or body coil (weekly)
3. processor sensitometric testing (daily) unless automatic sensitometry is not available

B. Medical Physicist Quality Control Tests (for Ontario guidelines, see Volume I, Chapter 2, Facilities, Equipment and Supplies--Quality Control)
The following quality control tests shall be reviewed by the medical physicist annually, and after any major upgrade or major change in equipment:

1. review of daily quality control testing records
2. measurement of image uniformity
3. measurement of spatial linearity
4. measurement of high contrast spatial resolution
5. measurement of slice thickness, locations and separations
6. assessment of image quality and image artifacts
7. eddy current compensation
8. system shim

All quality control testing shall be carried out in accordance with specific procedures and methods. Preventive maintenance shall be scheduled, performed and documented by a qualified service engineer on a regular basis. Service performed to correct system deficiencies shall also be documented and service records maintained by the MR site.

XII. ACCEPTANCE TESTING
Acceptance testing is intended to measure quantifiable system parameters which may then be compared to the manufacturer’s specifications. A complete evaluation of the system performance shall be conducted by a medical physicist after completion of
installation and prior to regular patient imaging.

Preventive maintenance shall be scheduled, performed and documented by a qualified service engineer on a regular basis. Service performed to correct system deficiencies shall also be documented and service records maintained by the MR site.

XIII. QUALITY IMPROVEMENT PROGRAM

A documented, systematic quality improvement program shall be established under the direction of the supervising physician in order to monitor and evaluate such problems as claustrophobia, sedation, administration of contrast agents, equipment malfunctions and accidents (such as metallic objects entering the scan room) endangering patients or workers. Monitoring should include the evaluation of the accuracy of radiologic interpretations as well as the appropriateness of examinations. Incidence of complications and adverse events should be recorded and periodically reviewed in order to identify opportunities to improve patient care.

Data should be collected in a manner that complies with statutory and regulatory peer review procedures in order to protect the confidentiality of the peer review data.

Notes

For specific details on techniques and indications, as a model, see ACR Reference Document MRI Indications and Techniques - 1992 for examples of: Brain; Head and Neck; Spine; Abdomen and pelvis, Musculoskeletal; Pediatric; Cardiovascular, Vascular/MRA; Safety and Sedation; and Quality Assurance. See also ACR Glossary of Terms, Third Edition, 1991.


Clinical Practice Parameters and Facility Standards – Magnetic Resonance Imaging 2nd Edition
CAR National Advisory on Gadolinium Administration and Nephrogenic Systemic Fibrosis

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APPROVED: SEPTEMBER 2008

As the authoritative national voice of radiology, the Canadian Association of Radiologists (CAR) is dedicated to providing up-to-date information on issues that affect patient health as related to the practice of radiology. As part of this commitment, CAR develops advisories aimed at providing clarification on issues when there are varying points of view. Developed and updated by CAR working groups, and approved by CAR’s Board of Directors, these advisories contain background information and evidence-based support of the Association’s stated position on various issues.

This advisory was developed through review of evidence-based research and consultations undertaken by the NSF Advisory Working Group for the CAR: Amie Padilla-Thornton M.D., Khashayar Rafat Zand M.D., Brendan Barrett M.D., Lawrence Stein M.D., George Andrew M.D., Bruce B. Forster M.D.

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Introduction:

In 1997, a new clinicopathological entity recognized by skin thickening and induration was described in patients with end-stage renal disease. The initial designation of Nephrogenic Fibrosing Dermopathy (NFD) was later revised once autopsy studies described widespread involvement of additional extra-cutaneous organs. Upon demonstration of collagen deposition and consequent fibrosis involving not only the skin but also skeletal muscle, lungs, heart, pulmonary vessels, diaphragm and esophagus, this new disease became known as Nephrogenic Systemic Fibrosis (NSF).

In 2006, exposure to gadolinium based contrast agents (GBCAs) was implicated in the pathogenesis of NSF. NSF is a rare and potentially fatal complication of certain GBCAs affecting patients with compromised renal function. Both the exact pathophysiology of, and importantly, a cure for NSF remain elusive. Partial clinical responses have been described following renal transplantation and hemodialysis, although no strong evidence exists in their support.

The widespread negative impact of NSF on utilization of contrast-enhanced MR imaging has clearly resonated worldwide. In response, the Canadian Association of Radiologists (CAR) Board Working Group (BWG) on NSF has developed the following guidelines to address practical issues applicable to Canadian radiologists and their patients. The CAR BWG represents a collaborative effort between radiology and nephrology. As data accumulates in various world-wide registries, these recommendations may change to reflect the most recent available evidence. Accordingly, all physicians are advised to remain current on NSF literature and future, revised guidelines.

Overview:

It is crucial that these practice guidelines be tailored to the individual patient via consultation with the referring physician, radiologist and when necessary, a nephrologist. The BWG recommends that all patients with chronic kidney disease consult their physicians regarding the risk of developing NSF following administration of GBCAs. Finally, it is imperative that clinicians recognize that NSF remains a rare complication of GBCA administration, even in high-risk patients. Therefore, considering the value of contrast-enhanced MR imaging as a diagnostic tool, it is incumbent that all physicians carefully assess the risks and benefits of GBCA administration to this patient population. NSF is a reportable disease. All suspected cases should be reported to Health Canada Canadian Adverse Drug Reaction Monitoring Program (CADRMP) via telephone (1.866.234.2345) or by fax (1.866.678.6789).

1- What GBCAs have been implicated in NSF?

The GBCAs available for clinical use in Canada have different reported incidences of NSF. In unconfounded cases, NSF has developed after administration of a single GBCA. In confounded cases, two GBCAs have been administered within approximately eight weeks before the development of NSF. Gadodiamide, or Gd-DTPA-BMA (Omniscan; GE Healthcare, Milwaukee, Wisconsin) accounts for 80-90% of unconfounded published and reported cases. NSF has also been reported with Gadopentetate Dimeglumine, or
Gd-DTPA (Magnevist; Bayer Schering Pharma AG, Berlin, Germany) and Gadoversetamide, or Gd-DTPA-BMEA (OptiMARK; Mallinckrodt Inc., Hazelwood, Missouri).

No unconfounded cases involving more tightly-chelated GBCA’s, Gadobenate Dimeglumine, or Gd-BOPTA (MultiHance; Bracco Diagnostics Inc., Princeton, New Jersey), Gadoteridol, or Gd-HP-DO3A (ProHance; Bracco Diagnostics Inc., Princeton, New Jersey), Gadofosveset Trisodium, or Diphenylcyclohexyl phosphodiester-Gd-DTPA (Vasovist; EPIX Pharmaceuticals, Lexington, Massachusetts) and Gadobutrol, or Gd-DO3A-butrol (Gadovist; Bayer Inc., Toronto, Ontario) have been reported.

2- How should renal function be assessed prior to administration of GBCAs?

It is the opinion of the BWG that it is not necessary to obtain an estimated glomerular filtration rate (eGFR) in all patients scheduled for GBCA administration. It is critical that radiologists and referring physicians be aware of the existence of silent renal failure. Findings from the National Health and Nutrition Examination Survey (NHANES) demonstrated that only 22% of patients with Stage 3 chronic kidney disease (CKD) and 45% of patients with Stage 4 CKD were actually aware of their renal compromise. However, it should still be remembered that the non-age adjusted prevalence of Stage 4 and 5 CKD in the United States is 0.4%.

A pre-examination questionnaire should be accurately completed for any patient scheduled to undergo an MRI examination that could potentially require administration of contrast. A sample screening questionnaire is depicted below:

Are you over the age of 60? Yes No
Do you have a history of:
Renal disease (solitary kidney, renal transplant, renal tumour) Yes No
Hypertension Yes No
Diabetes Yes No
Stroke Yes No
Myocardial infarction Yes No
Peripheral Vascular disease Yes No
Organ transplantation Yes No
Chemotherapy for malignancy Yes No

If the screening form reveals risk factors for CKD, the eGFR should be calculated from serum creatinine using the Cockroft-Gault or Modification of Diet in Renal Disease (MDRD) formulae.

Patients whose renal function is known are exempt from such screening. An eGFR obtained within 3 months for outpatients, as long as no interval hospitalization has occurred, or within 48 hours for inpatients is acceptable.

GBCA administration can be hazardous for patients with acute kidney injury (AKI), the severity of which may not be accurately reflected in the most recent available eGFR. If AKI is suspected, nephrology consultation is recommended to accurately assess the patient’s renal function.
Some MR centres use GBCA at higher doses than recommended by the manufacturer (‘off-label’ use). While the CAR cannot condone this practice, it is acknowledged that such doses are administered in certain exams (e.g. cardiac MRI, MR angiography, MR urography, and breast MRI). It is strongly recommended that renal function be determined prior to performing these studies in all patients, regardless of risk factors.

3- Is GBCA dose adjustment necessary in patients with CKD?

As a rule, the lowest possible dose to achieve a diagnostic examination should always be used.

For patients with Class 3 CKD (eGFR 30-60 mL/min/1.73m²): Excluding patients with AKI, the risk of developing NSF with exposure to GBCAs is exceptionally low in the stable patient, assuming an accurate assessment of renal function has been made. Therefore, adjustment of dose and specific discussion of the risk of NSF is not required in this group.

For patients with Class 4 or 5 CKD (eGFR <30 mL/min/1.73m²): In this higher risk group, it is important to confirm that the GBCA enhanced examination is indeed necessary and that other imaging tests (i.e. non contrast MRI, non-contrast CT or ultrasound) would not provide the required information. However, physicians should not deprive at-risk patients of clinically indicated contrast enhanced MR examinations. Therefore, if such an examination is deemed critical to guide future clinical management, it is recommended that a nephrology consultation be considered for patients with an eGFR <30 mL/min/1.73m² as long as the MR examination can be delayed to allow such a consult without adversely affecting the patient outcome. This recommendation for nephrology involvement may be subject to regional nephrology opinion. Gadodiamide (Omniscan), Gadopentetate Dimeglumine (Magnevist) and Gadoversetamide (OptiMARK) are to be avoided in patients with an eGFR <30 mL/min/1.73m². Instead, the use of a tightly chelated agent is recommended at the lowest dose that yields a diagnostic study.

In patients with Class 4 or 5 CKD, informed consent should be obtained prior to administration of GBCAs. The consent should include an estimate of the risk of NSF following GBCA administration, a description of the signs and symptoms of NSF and possible sequelae, as well as the timeline of signs and symptoms following GBCA administration. The effectiveness of current treatments for NSF, namely hemodialysis and renal transplantation, should also be discussed. The importance of diagnostic information provided by contrast enhanced MR in directing further management should be emphasized. Patients should be instructed to seek urgent medical attention should the symptoms develop.

To enhance the knowledge of referring physicians and hospital house-staff regarding NSF, it is recommended that any patient scheduled for a contrast enhanced MRI with an eGFR <30 mL/min/1.73m² should first be provided with the above information at least several days prior to his or her appointment (either by fax or reference to website content) to optimize the informed consent process. Repeated administration of GBCAs has been shown to be a risk factor in the development of NSF.
Repeated use of GBCAs in patients with abnormal eGFR values, especially within a short interval up to one week, should be undertaken with caution. In patients with chronic kidney disease, physicians should strongly consider the risks of using GBCAs instead of iodinated contrast in examinations such as CT or diagnostic angiography in an effort to prevent contrast-induced nephropathy (CIN). The risk of NSF, although probably lower than CIN, remains an important consideration in these patients.

**4- What is the role of renal protective measures in NSF?**

Currently, there is no data to corroborate the institution of renal protective protocols such as aggressive hydration or bicarbonate administration in patients at risk of NSF. Hemodialysis has been shown to effectively remove GBCA from the circulatory system with approximately 98% eliminated after three dialysis sessions. While the BWG recognizes that hemodialysis may not prevent NSF, hemodialysis should be considered in patients with an eGFR <30 mL/min/1.73m² following GBCA administration. All contrast-enhanced MR examinations in patients on dialysis (hemo- or peritoneal) should be organized in collaboration with the nephrologist. Given that these dialysis dependent patients represent the cohort most at risk for NSF, hemodialysis is recommended as soon as possible following GBCA administration.

**5 Are there any guidelines regarding paediatric and obstetrics patients?**

This Advisory is primarily directed towards the non-obstetrical and non-paediatric age groups. eGFR is not routinely required in either of these groups, and it should be remembered that the accuracy of such measures in these patients can be compromised. Nevertheless, the usual consideration of risks and benefits of MRI and Gd-enhanced MRI should occur. For example, a subgroup of paediatric patients are expected to have many Gd-enhanced MR imaging studies over their childhood and adolescence. Many receive treatments such as chemotherapy and bone marrow transplantation which can impair their renal function. As estimation of GFR using serum creatinine levels in children and neonates is not optimal, and since little data is available regarding the incidence of NSF in this age group, this clinical scenario will be subject to regional opinion regarding the need for Paediatric Nephrology consultation prior to repeated administration of GBCAs, and will require specific discussion in future Advisories.

**Conclusion:**

It is important to re-iterate that these practice guidelines be tailored to the individual patient’s specific clinical circumstance. Given the powerful diagnostic potential of contrast-enhanced MRI, if the benefits of GBCA administration are outweighed by the risks, the aforementioned guidelines provide a framework for the appropriate work-up and management of patients with CKD.
References:

11. Schwartz GJ, Furth SL. Glomerular filtration rate measurement and estimation in chronic
Independent Health Facilities
Clinical Practice Parameters and
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Magnetic Resonance Imaging

VOLUME 3
Teleradiology (PACS)
CAR Standards for Teleradiology

Approved: May 2008

These Standards were developed, in collaboration with the Canadian Association of Medical Radiation Technologists by PACS / Teleradiology Committee members, Benvon Cramer M.D., Gregory Butler M.D., Jean Chalaoui M.D., Kelly Silverthorn M.D., Luigi Lepanto M.D., David Koff M.D.

The standards of the Canadian Association of Radiologists (CAR) are not rules, but are guidelines that attempt to define principles of practice that should generally produce radiological care. The physician and medical physicist may modify an existing standard as determined by the individual patient and available resources. Adherence to CAR standards will not assure a successful outcome in every situation. The standards should not be deemed inclusive of all proper methods of care or exclusive of other methods of care reasonably directed to obtaining the same results. The standards are not intended to establish a legal standard of care or conduct, and deviation from a standard does not, in and of itself, indicate or imply that such medical practice is below an acceptable level of care. The ultimate judgment regarding the propriety of any specific procedure or course of conduct must be made by the physician and medical physicist in light of all circumstances presented by the individual situation.
I. DEFINITION

Teleradiology is the electronic transmission of diagnostic imaging studies from one location to another for the purposes of interpretation and/or consultation.

This definition includes interfacility PACS networks as well as remote teleradiology. An onsite supervising qualified radiologist provides the optimum clinical environment for patients and referring physician providing daily interaction, input and consultation. Where there is difficulty in filling manpower needs, teleradiology will provide support for night, weekend and vacation leave, for excess workload and for interpretation of complex cases.

Teleradiology must be a quality centered, patient focused method of augmenting services. It must never compromise the radiologist responsibility to provide quality professional services.

Teleradiology will also allow more timely and efficient interpretation of radiological images, give greater access to secondary consultations and improve continuing education. To achieve this, appropriate technology must be utilized according to the CAR standards (see below).

It is recommended that teleradiology is directed by the local radiologist if present and provided in all circumstances preferentially at local, regional, and provincial centers respectively prior to being sent nationally.

II. QUALIFICATIONS AND RESPONSIBILITIES OF PERSONNEL
A. Radiologists

A Radiologist is a specialist physician, who uses imaging based modalities and techniques in the practice of medicine for diagnosis and treatment. Teleradiology is one of these imaging based techniques.

Radiologists involved in the performance, supervision and interpretation of teleradiology must have a Fellowship or Certification in Diagnostic Radiology with the Royal College of Physicians and Surgeons of Canada and/or the Collège des médecins du Québec.

Also acceptable are equivalent foreign Radiologist qualifications if the Radiologist is certified by a recognized certifying body, holds a valid Canadian provincial license and is appropriately credentialed in the site where the imaging was performed.

As new imaging modalities and interventional techniques are developed additional clinical training, under supervision and with proper documentation, should be obtained before radiologists interpret or perform such examinations or procedures independently. Such additional training must meet with pertinent provincial/regional regulations. Continuing professional development must meet with the requirements of the Maintenance of Certification Program of the Royal College of Physicians and Surgeons of Canada.

The official interpretation of images must be done by a radiologist with an understanding of the basic technology of Teleradiology including its strengths and limitations. Provision must be made by the reporting radiologist to provide a consultative service. The reporting radiologist has a pivotal role in all aspects of the diagnostic imaging examination. This includes appropriateness screening, supervision of technical standards and procedures, image interpretation and consultation. This safeguard allows teleradiology to be equivalent to on-site radiology in selected instances.
The radiologist workload for teleradiology and on site should be at a level that quality of care and interpretation accuracy are not compromised. The local, or if unavailable, reporting radiologist should therefore be involved in decisions involving teleradiology. If there is no local radiologist, then the reporting radiologist or another radiologist must regularly visit the department for quality control.

B. Technologists

The Medical Radiation technologist must meet the certification requirements for the province in which they are practising. For most provinces, for MRT this would be certification by either the CAMRT or the Ordre des technologues en radiologie du Quebec. For Sonographers, this would be certification by ARDMS or CARDUP.

Under the overall supervision of the radiologist, the technologist will have the responsibility for evaluation and operation of the equipment and the applicable quality assurance program. In remote sites, technologists need ongoing feedback and supervision from the radiologist responsible for the teleradiology system's quality assurance program.

Continuing education of technologists must meet the Provincial regulations. Sonologists performing tele-ultrasound should receive hands on experience, preferably under the guidance of the radiologist supervising the tele-ultrasound facility.

C. Others

Teleradiology services must have access to medical physicists, bioengineers and image communications specialists, or image management system specialists on-site or as consultants on an "as needed" basis.

III. EQUIPMENT STANDARDS

Digital imaging sent by Teleradiology will usually originate from a PACS system. In occasional circumstances, the digital conversion of hard copy or analogue images may be necessary if the transmitting site does not have PACS. The scanner used must not reduce the digital resolution below that considered an acceptable threshold as indicated in the next section.

A. Specific Standards

Specifications for equipment used in teleradiology will vary depending on the individual facility’s needs, but in all cases it should provide image quality and availability appropriate to the clinical need. Compliance with the current DICOM and Canadian IHE standard is required for all new equipment acquisitions, and consideration of periodic upgrades incorporating the enhancements recommended in that standard should be part of the continuing quality improvement program.

Equipment guidelines cover two basic categories of teleradiology when used for rendering the official interpretation: small matrix size (e.g., computed tomography [CT], magnetic resonance imaging [MRI], ultrasound, nuclear medicine, digital fluorography, and digital angiography) and large matrix size (e.g., digital radiography and digitized radiographic films). For small-matrix, the data set should provide a minimum of 512 x 512 matrix size at a minimum 8-bit pixel depth for processing or manipulation with no loss of matrix size or bit depth at display. For large-matrix, the data set should allow a minimum of 2.5 lp/mm spatial resolution at a minimum 10-bit pixel depth.
These pixel depths are the standard in the absence of compression, and will need adjustment if compression is used as per the lossy compression standards when these are implemented.

B. Acquisition or Digitization

Initial image acquisition should be performed in accordance with the appropriate CAR modality or examination guideline or standard.

1. Direct image capture

The entire image data set produced by the digital modality in terms of both image matrix size and pixel bit depth, should be transferred to the PACS / teleradiology system. The DICOM standard must be used.

2. Secondary image capture

a. Small-matrix images: Each image should be digitized to a matrix size as large as or larger than that of the original image by the imaging modality. The images should be digitized to a minimum of 8 bits pixel depth. Film digitization or video frame grab systems conforming to the above specifications are acceptable.

b. Large-matrix images: These images should be digitized to a matrix size corresponding to 2.5 lp/mm or greater, measured in the original detector plane. These images should be digitized to a minimum of 10 bits pixel depth.

These pixel depths are the standard in the absence of compression, and will need adjustment if compression is used as per the lossy compression standards when these are implemented.

C. Mammography and Fluoroscopy and Ultrasound

i) Mammography:

Digital Mammography is evolving rapidly but at this time primary reading is not performed on PACS systems. This standard will be updated as tele-mammography technology matures.

ii) Fluoroscopy:

At present the standard for fluoroscopy is to have a radiologist performing the examination. If physician extenders are to be utilized in the future, it is also recommended that there is a supervising radiologist on-site. There may be exceptions when fluoroscopic images can be transmitted for interpretation via teleradiology.

iii) Tele-Ultrasound

A radiologist must be available for consultation with the sonographer on a case by case basis. Ideally the radiologist should be on-site and available to participate actively in the ultrasound examination when required. It is recognized however that the geographic realities in Canada do not permit the presence of an on-site radiologist in all locations. Adequate documentation of each examination is critical and should include sonographer annotations and if necessary video clips. As with all aspects of teleradiology, the reports must be timely and the radiologist must be available by telephone for consultation with the sonographer and the referring physician. The radiologist should visit the facility on a regular basis to provide on-site review of ultrasound procedures and sonographer supervision.
D. General Standards

1. Image Management

Most teleradiology systems are now PACS systems with network connections with a few remaining point to point systems. All systems shall include an integrity checking mechanism to ensure that all transmitted information from the site of origin is received intact by the reviewing site as well as:

a. Capability for the selection of the image sequence for transmission and display at all the reviewing sites.

b. The patient must be identified accurately and unambiguously. This may include patient name, identification number, date and time of examination, film markers, institution of origin, type of examination, degree of compression (if used) and a brief patient history. This information should be bundled with the image file but may also be transmitted by other secure means e.g. fax.

c. Capacity to obtain prior examinations and reports.

d. The issue of compression is currently under investigation by members of the CAR PACS /Teleradiology committee who hope to define and recommend compression levels for varying modalities. In the interim compression should be used judiciously.

e. Image storage at either the acquisition or reviewing site as well as transmission must be arranged such that patient confidentiality is maintained and that the system is secure.

f. The provider must ensure that the image quality is the same at the acquisition site and reviewing site(s).

E. Transmission of Images and Patient Data

Communications protocols, file formats and compression shall conform to the current DICOM and Canadian IHE standard. There should be provision for the selection of appropriate compression for improved transmission rates and reduced archiving/storage requirements. There must be no reduction in clinically diagnostic image quality. The types and ratios of compression used for different imaging studies transmitted and stored by a system must be selected and periodically reviewed by the responsible physician to ensure appropriate clinical image quality. A more specific recommendation will be provided following the compression study that is currently in progress.

F. Display Capabilities

Display workstations employed for teleradiology / PACS systems must provide the following characteristics:

1. Luminance of the gray-scale monitors of at least 50 foot-lamberts.

2. Display stations must accurately reproduce the original study and must include:

   a. brightness and contrast and/or interactive window and level function

   b. a magnification function

   c. the capability of rotating and flipping the displayed images

   d. the capability of accurate linear measurements and CT Hounsfield units
e. the capability of inverting the gray-scale values of the displayed image
f. the capability to display clinically relevant parameters

G. Patient Database
For radiological images transmitted by PACS / Teleradiology, a database must be available that includes.

1. patient name, identification number and date
2. type of examination e.g. Chest
3. modality e.g. CT, MRI etc.
4. number of images
5. image acquisition site
6. date and time of acquisition and availability for review

H. Security
Teleradiology systems must provide network and/or software protocols to protect the confidentiality of the patient's record(s), image(s), interpretation(s) and other data and insure that the system is secure and used only on an as needed basis by those authorized by the patient in accordance to provincial privacy of information legislation and CMA guidelines.

I. Reliability and Redundancy
Quality patient care may depend on timely availability of the image interpretation. There should be an internal redundancy system, backup telecommunication links, and a disaster plan.

IV. STORAGE OF RECORDS
The legal requirements for the storage and retention of images and reports will vary from province to province and the providers of the teleradiology service are responsible for adhering to these requirements.

Images stored at either the acquisition or reviewing site shall meet the jurisdictional requirements of the acquisition site. Images interpreted off-site need not be stored at the reviewing facility provided that they are stored at the acquisition site. The policy on record retention should be in writing and may in part reflect the accreditation requirements of the two facilities involved.

V. DOCUMENTATION
Communication is a critical component of teleradiology. Radiologists interpreting teleradiology examinations shall render reports in accordance with the CAR Standard of Communication.

VI. QUALITY CONTROL FOR TELERADIOLOGY
The interpreting radiologist has to ensure that the quality of the images being reviewed is of acceptable standard.

It must be stressed that the images at the reviewing site can only be as good as the images generated at the acquisition site. It is imperative that a radiologist should
visit the acquisition site on a regular basis to ensure that the equipment is functioning properly and that the technologists are adequately supervised and trained.

Both the acquisition and reviewing sites must have documented policies and procedures for monitoring and evaluating the effective management, safety, proper performance of imaging, transmitting, receiving and display equipment.

The quality control program should be designed to minimize patient, personnel and public risks, and to maximize the quality of the diagnostic information. Equipment performance must be monitored at intervals consistent with proper quality control.

Important parameters must be accompanying the transmitted study when used for the official authenticated written interpretation. These will include, at a minimum, the matrix size, bit depth, compression (if used), and what kind of image processing, if any, was used (edge enhancement etc.).

A radiologist must be involved in the selection of imaging systems at both the reviewing and acquisition sites. In this period of fiscal restraint, it is important to ensure that the scarce healthcare resources are used to acquire diagnostically acceptable equipment, which has been approved by a duly qualified diagnostic imager.

VII. QUALITY IMPROVEMENT

The use of teleradiology does not reduce the responsibilities for the management and supervision of diagnostic imaging. Procedures must be systematically monitored and evaluated as part of the overall quality improvement program of the facility. Monitoring shall include the evaluation of the accuracy of the interpretations as well as the appropriateness of the examination. Incidence of complications and adverse events must be reviewed to identify opportunities to improve patient care.

With the increasing use of PACS technology, radiologists should ensure that institutions identify and train PACS administrators (image management specialist). Their responsibilities would include the monitoring of quality and confidentiality of transmitted images and to maintain a viable system.

The increased use of networking also allows for remote auditing and peer review when required.

VIII. LICENSING, CREDENTIALING AND LIABILITY

a) In order to protect the patient, the radiologist must be licensed in the province in which the patient undergoes the examination. The radiologist must also comply with the regulations of the jurisdiction where he or she is physically present during the performance of the interpretation.

b) The radiologist must be appropriately credentialed at the site in which the examination is performed when this is required by that site.

The radiologists who are involved in practicing teleradiology will conduct their practice in a manner consistent with the bylaws, rules, and regulations for patient care at the site in which the patient undergoes the examination.

c) The radiologist must carry appropriate malpractice coverage. This must be valid in the province in which the patient undergoes the examination.

ACR/NEMA - the American College of Radiology and the National Electrical Manufacturers Association
**Bit (Binary Digit)** - the smallest piece of digital information that a computing device handles. It represents off or on (0 or 1). All data in computing devices are processed as bits or strings of bits.

**Canadian IHE** – Integrating the Healthcare Enterprise. A national vision of a connected and interoperable healthcare infrastructure

**Data Compression** - methods to reduce the data volume by encoding it in a more efficient manner, thus reducing the image processing and transmission times and the storage space required.

**DICOM (Digital Imaging Communications in Medicine)** - a standard for interconnection of medical digital imaging devices, developed by the ACR/NEMA committee.

**Digitize** - the process by which analog (continuous wave) information is converted into digital (discrete value) information. This process is a necessary function for computer imaging applications because visual information is inherently in analog format and most computers use only digital information.

**Gray Scale** - the number of different shades or levels of gray that can be stored and displayed by a computer system. The number of gray levels is directly related to the number of bits in each pixel: 6 bits = 64 gray levels, 7 bits = 129 gray levels, 8 bits = 256 gray levels, 10 bits = 1024 gray levels and 12 bits = 4096 gray levels.

**K (Kilo)** - stands for the number one thousand (1,000). It is used primarily when referring to computer storage and memory capacities. E.g. 1 Kbytes = 1024 bytes.

**Lossless** - no loss of the original digital information upon reconstruction of the digital image.

**Matrix** - an image formed by distinct points in both the horizontal and vertical directions. E.g. a 512 matrix is made up of 512 points in one axis and 512 points in the other.

**PACS** – Picture Archival and Communication System

**Resolution** - the ability of an imaging system to differentiate between objects.

**Sonographer** - a technologist approved by the regional licensing body to perform diagnostic ultrasound services.
OAR Teleradiology Practice Standard

Ontario Association of Radiologists

June 2007

OAR TELERADIOLOGY PRACTICE STANDARD

Definition

Teleradiology in Ontario is the electronic transmission of radiographic images from one geographical location to another for the purposes of interpretation and consultation by diagnostic imaging physicians accredited by the Royal College of Physicians and Surgeons of Canada (or recognized equivalent) and licensed by the College of Physicians and Surgeons of Ontario. These guidelines and standards have been developed to protect patients and ensure their data is kept confidential. Teleradiology services are to facilitate patient care and are not intended to be a cost-cutting measure, which may jeopardize patient safety and the standards of health care.

Preface

The transmission of images between centres has been going on for a number of years and has proved to be valuable for centres seeking expert opinions on emergency and problem cases. The most common such connections have been with radiologists who work at a site and are now able to offer image interpretations online from other sites within an institution, from their offices, home or elsewhere. More recently radiological images have been transmitted to main centres from smaller community hospitals in areas of low population density where small radiology departments have proven unsustainable. The vastly improved capacity of the internet and the speed of transmission have permitted a much wider use of teleradiology.

Teleradiology has advantages but it must be done properly to ensure that a high quality of care is provided to patients and to maintain the radiologist interaction with their clinical colleagues. It is also important that those radiologists providing the service are properly trained, are registered with the appropriate authorities, and undergo continuing update through Continuing Medical Education (CME). The services provided must be open to audit and the ability to discuss cases with those reporting the studies must be available. This standard has been developed to provide guidance to radiologists, managers of health care facilities, patient’s representatives and governments on appropriate standards for teleradiology services.

Teleradiology has undergone a number of health-technology assessments in different countries with regard to the context of its use, but a great deal of thought and study is still required. Teleradiology clearly has a number of advantages, but it also has the potential to create considerable difficulties for the delivery of a high quality radiological service to patients, unless its role and the legal responsibilities involved are clearly defined.
Role of a Diagnostic Radiologist

The role of a radiologist providing medical services in a diagnostic imaging service is considerably wider than simply issuing a diagnostic interpretation and report. It includes:

• Evaluating the clinical information produced by referring physician clinicians
• Deciding which test is appropriate
• Establishing and assuming responsibility for the imaging protocols, quality parameters and a host of other technical factors that are integral to the creation of the diagnostic image and report
• Being responsible for the technical staff/standards involved in the diagnostic imaging facility
• Optimizing the study and assisting the referring physician colleague
• Evaluating the study and relating it to the clinical findings
• Having knowledge of the practice of referring physicians
• Reviewing previous examinations and their interpretations to compare them with the current study
• Identifying further appropriate management including diagnostic investigations essential to obtain a comprehensive diagnosis and treatment, and reviewing those recommendations with referring physicians
• Reviewing all clinical data in a multi-disciplinary environment
• Performing interventional therapeutic and diagnostic procedures
• Assuming responsibility for the appropriate management of the patient during the diagnostic imaging procedure
• Contributing radiological expertise to the management of the diagnostic imaging service to ensure the highest possible quality assurance and quality control
• Being responsible for patient safety by ensuring minimal exposure to radiation dose and other matters that could compromise patient care
• Adhering to all provincial and federal regulations, statutes relating to the delivery of medical services generally and diagnostic imaging services provincially; meeting and exceeding the standard of care in the delivery of diagnostic imaging services in the province; maintaining membership in all of the licensing bodies and fulfilling the requirements of that licensure regime
• Ensuring the selection and use of appropriate and modern equipment, properly trained staff and other elements in the high quality delivery of diagnostic imaging
• Where relevant, teaching radiology residents and fellows according to national training program requirements
• Where relevant, participating in radiology research
• Auditing the delivery of radiology services in the sites where the radiologist works
• Ensuring timely communication of urgent findings
• Maintaining appropriate records/confidentiality as mandated by legislation

In essence, appropriate teleradiology in this era is the same as the whole practice of radiology. The fact that patient data can be moved over a broadband connection does not alter the role or responsibilities of the supervising and interpreting radiologist.
The importance of interaction between the referring clinicians and the radiologist cannot be over-emphasized. There are considerable quality patient care and medical-legal implications when teleradiology services are provided by a radiologist outside the patient’s jurisdiction. Regulatory bodies, licensing and credentialling (including the College of Physicians and Surgeons of Ontario, the Royal College of Physicians and Surgeons of Canada, Health Protection Branch, the Ministry of Health’s Independent Health Facility branch, OHIP, X-ray Inspection branch, and other provincial and federal bodies), are unable to enforce regulations outside their jurisdiction yet have a responsibility to patients with respect to the enforcement of a wide spectrum of regulations and statutes inter-linked to the high quality delivery of radiologists’ services in the province. The requirements of these and other related bodies are constantly subject to change requiring the radiologist to comply with a new and more stringent degree of responsibility with respect to the delivery of patient care.

Key Principles

1. Diagnostic radiology is an integrated medical service required in every modern health care system.

2. Referring physicians are dependent upon the local availability of diagnostic imaging physicians to assist them to manage the health of their patients.

3. Only fully qualified diagnostic radiologists should provide the teleradiology service. They must be properly accredited, registered, and licenced in Ontario. The radiologist should be subject to licensing and quality assurance requirements of the provincial health authority; legislative and professional requirements of the facility providing the service; the provincial College of Physicians and Surgeons, accreditation and be in good standing with the Royal College of Physicians and Surgeons of Canada.

4. A definitive report is mandatory with the signature of the reporting radiologist. Electronic signatures are acceptable as long as they can be authenticated.

5. In a public hospital the members of the radiology department must be credentialed and be part of the recognized medical staff.

6. The department head via the Medical Advisory Committee (MAC) and Board is responsible for the medical service.

7. In an Independent Health Facility (IHF), the off-site radiologist must be approved by the radiologist Quality Advisor who is legislatively responsible for Quality Control/Quality Assurance (QC/QA) at the IHF.

8. All radiologists providing teleradiology services must be covered by the Canadian Medical Protective Association (CMPA) for medical liability issues and ensure they are compliant with current CMPA guidelines and policies covering diagnostic imaging physicians to safeguard patient interests.

9. Ensure that all radiologists and their staff involved in the delivery of teleradiology services are in full compliance with relevant privacy legislation and facility policies to protect patient confidentiality.

10. Ensure that the information received for a primary read is the full data set and that the reading radiologist should have all of the functionality of the PACS at his/her disposal to do an interpretation.

Key Management Issues
1. Teleradiology services must be organized between the source radiologists and the off-site radiologist provider to guarantee the proper management of the patient. This will ensure that:

   a. The clinical evaluation and data is provided with the request for the examination.
   
   b. The requirements of the Healing Arts Radiation Protection Act (HARP) (including justification, appropriate techniques, optimization, and good procedure) are fulfilled.
   
   c. The report of the teleradiology service can be reviewed with clinicians and where applicable, in multi-disciplinary meetings and integrated with patients’ notes and previous studies.
   
   d. The reporting radiologist of the teleradiology service is able to communicate directly with the referring radiology department and clinicians in order to discuss the clinical background and unexpected diagnosis, which may be relevant to the timely management of the patient.
   
   e. Teleradiology services that are developed to meet the needs of rural, remote and small community areas must be linked to the nearest substantive radiology department and the service is managed by that department. The radiologists involved in providing the service must have a close connection and knowledge of referring clinicians, and technologists, and should understand any particular local disease and cultural factors.

2. Equipment used for teleradiology should provide a similar level of resolution and functionality as is available in the radiology department/facility.

3. The American College of Radiology’s (ACR) Technical Standard for Teleradiology for equipment and other supporting technologies used in the delivery of teleradiology is the acknowledged current technical standard. Radiologists delivering teleradiology standards are expected to comply or exceed the ACR Technical Standard for Teleradiology.

Real and Potential Problems

Clinico-Radiological Communication

If reporting of radiographs is taken away from close proximity with the patient, the clinical contact between the referring clinicians and radiologists is substantially reduced. It is imperative that teleradiology facilities have phone links with the hospitals and/or clinics from which images are obtained, and have the ability for direct discussion between a referring clinician and the reporting radiologist on individual cases. Without this, the bond between the patient and the radiologist becomes unclear. If urgent or significant unexpected features are found, the teleradiology service must transmit them directly to the referring clinician. This will be impossible unless there is a clear point of contact for the teleradiology service.

Team Working

The ability to hold multi-disciplinary meetings is much more difficult with teleradiology, even with teleconference links. It is now widely accepted that multi-disciplinary meetings, which are often led by the radiology department, are essential in the management of problematic cases, i.e., cancer care. They maximize the understanding of the clinical problems by radiologists.
External reviews of health care disasters have emphasized the importance of teamwork especially in medicine and the need for enhanced teamwork, involving radiology has been highlighted. Interaction between different members of the hospital team with radiology may be impaired, if radiology is undertaken at the long distance by a teleradiology link.

**Communication**

*It is necessary that there be good communication between referring physicians, radiologists and technologists.*

**Wording of Report and Clinical Impact**

Even if radiologists and referring clinicians have a common first language, it has to be recognized that radiological reporting may be subject to regional variation. Radiological reports often rely on verbal expressions of probability and may contain some regionally used expressions.

Modern imaging commonly demonstrates an abundance of reportable findings, some of which are clinically relevant and some of which are incidental findings/pseudo-disease. Multiple pathologies can exist in the same patient. The clarity and certainty conveyed in the text is particularly important in converting a report that is merely ‘diagnostically accurate’ into one that has a diagnostic outcome and potentially a therapeutic outcome for the patient. Clinicians are more likely to act on the nuances intended in a report generated by a radiologist with whom they regularly liaise compared with a report generated by a third party teleradiology service from someone they never met. Specific wording of reports for general family doctors may be necessary, which is different from the reports to specialists within their sphere of interest. Familiarity with the referring doctors can make specific reports more appropriate and useful. Knowledge of referring doctors can make specific reports more appropriate. Health care delivery varies between different jurisdictions. Recommendations for further imaging/specialist referral, which might be appropriate in the locale where a teleradiology service is provided, may be inappropriate in the area where the patient is located.

**Access to Previous Examinations/Interpretations**

The failure to review previous examinations and interpretations has been shown to be a significant cause of errors in both perception and cognition. It is therefore important that previous studies and reports are available to the reporting radiologist where these are relevant. This should be possible if the teleradiology service has access to the referrer's PACS system. There also has to be access to the hospital information system, so relevant lab data and clinical notes can be reviewed.

**Downstream Costs**

Teleradiology may generate significant downstream costs. There is potentially increased cost from recommendations by the teleradiology service (which may actually be unnecessary) are required due to the inexperience or insecurity of the reader of the initial study or from clinicians responding to reports describing clinically insignificant radiological findings. There may be variations in the style of practice in different jurisdictions that impact the kind or volume of studies ordered. This problem will be compounded by a potential lack of background clinical knowledge of the case and the clinical expectations of the referring clinician by the teleradiology service. Clinicians who are not confident in a report from a teleradiology service may ask radiologists with whom they work to re-report the images and to advise on case management, thus leading to
duplication and poor use of financial resources. For all of these reasons, the importance of close communication between the radiologist and the clinician to minimize inappropriate clinical referrals for imaging cannot be over emphasized.

**Quality Control and Quality Assurance**

Quality control is paramount with teleradiology in order to prevent errors in radiology. Learning from mistakes through participation in radiological discrepancy/error meetings is established practice. Much informal feedback occurs at clinico-radiological meetings and corridor encounters. Audit is another potent form of radiological quality assurance. All these activities are much more difficult for a teleradiology service which would need a very close link between the radiologists and clinicians at the source hospital/facility. It is difficult for teleradiology services to have a proper feedback of the outcome and undertake satisfactory audit of their reports.

Radiologists providing services may provide advice relating to radiation exposure, image quality, patient positioning, and several other quality assurance and quality control (QA/QC) issues based on images they have received for interpretation. They must communicate directly with technologists, often real time, so as to be able to intervene directly to ensure optimal QA and QC. The Radiation Protection Officer, an on-site radiologist, remains responsible for the overall QA and QC and ensuring safe operation of a facility.

**Legal Issues**

There are a number of potential legal issues.

a. The registration of the reporting doctors must be accredited by the regulatory body of the local jurisdiction of a hospital/facility or the health authority purchasing the service. This is an essential requirement in order to maintain proper standards of practice. The reporting radiologists must demonstrate that they undergo appropriate CME and are properly trained in the tasks to be undertaken.

b. The providers of the service must abide by the jurisdiction’s health and safety legislation.

c. The use of radiology also creates difficulties in terms of the medico-legal issues and the medico-legal responsibilities of the referring hospital/facility and that of the reporting teleradiology services must be identified. Any radiologist that reviews images has a responsibility. Liability may also reside with the purchasers of the radiology service and/or the employers of the “radiologist”. It must be clear who maintains responsibility for the patient. It is clear that the “radiologist” has a direct responsibility for the patients whose study they interpret. Teleradiology providers would have to comply with any statutory duty of candor to inform the hospital/facility and patient(s) when they become aware of a negligent act or omission. At present, the legal status of teleradiology remains to be clearly established.

d. Consent. It is not clear whether the patients will be required to give explicit consent for their images to be transferred to another country or different provincial jurisdiction for reporting.

e. Jurisdiction. An individual has the right to sue a company providing electronic services within another country and the suit would be heard in the patient’s own country or provincial jurisdiction.
f. Patient confidentiality. The teleradiology service must ensure patient confidentiality and be of adequate technical specification. It must comply with the data protection legislation in the transmitting and receiving provincial jurisdiction.

g. There is increasing awareness of the need to reduce the radiation dose that many patients receive, particularly CT scanning. When creating teleradiology contracts, it must be made clear who has responsibility for defining the protocol of an individual imaging study, e.g. high or low dose depending on clinical indication. Teleradiology providers need to comply with pertinent directives mandated in the provincial jurisdiction.

Guidelines for the Development and Appropriate Use of Teleradiology

1. The principle that the patient is best served by a close liaison between the patient, the clinicians and the clinical radiology department should be paramount.

2. The radiologist’s expected duty of care to the patient must not be compromised, lowered, or altered in any way by the use of teleradiology.

3. Teleradiology referrals should, be in the majority of cases, organized between clinical radiologists and the teleradiology provider. It is important that the radiologists act as practitioners under the statutes, regulations, directives, policies, bulletins, bylaws issued by provincial and local hospital/clinic authorities in order to ensure that appropriate investigations are performed and to justify any further investigations suggested by the reporting radiologist.

4. The full agreement of radiologists should be obtained in order for the development of teleradiology services to be implemented.

5. Teleradiology services developed for rural, remote and/or under-serviced areas should be linked to other facilities in the province of Ontario and the service should be managed by the receiving department/clinic unless there is a radiologist at the originating centre who may elect to assume that responsibility or share it with the receiving centre radiologist. The radiologists involved in providing the service should have close communication with the referring clinicians and patients and should understand any particular local disease and cultural factors.

6. The radiologists providing the service must be properly accredited and registered within the provincial jurisdiction where the patient receives the service. They should also be registered and subject to quality and revalidation requirements, where applicable.

7. Under no circumstances should teleradiology reports be made by radiologists in training without supervision and the implementation of teleradiology should not be to the detriment of the training in the originating centre.

8. The use of subspecialty services should be for the benefit of a second opinion or for the immediate transfer of patients to specialist centres and not for the centralization of subspecialty reporting away from general hospitals/clinics.

9. The reporting radiologist of the teleradiology service must be able to communicate directly with the referring radiology department and clinicians in order to discuss the clinical background and unexpected diagnosis which may be relevant to the timely management of the patient. The equipment used to undertake the whole process of teleradiology must be of a quality and standard that provides diagnostic quality images at all times.

10. Proper audit procedures should be in place in order to check the quality of the teleradiology service, the accuracy of the radiological reports and the overall
therapeutic and clinical impact of the service. This must include user/clinician feedback.

11. The teleradiology service must comply with all national and provincial data protection standards. Transfer of images outside the province could pose significant problems of data protection. It is essential that the privacy and the integrity of patient information must be preserved at all times.

12. There needs to be clearly defined agreement with the teleradiology service with regard to confidentiality of the images which should allow retention for comparison, proper defense against litigation or other clinically appropriate reason.

13. The legal arrangements must be clearly defined between the user and the provider so that proper restitution may be made to patients, if errors are made. If the service is less than optimal, patients should not be required to litigate in the foreign country in the event of a complaint unless they have consented formally to the transfer of their rights for local litigation in addition to initial image transfer.

14. At all times the provision of teleradiology must be primarily developed in the best interest of the patient care and not as a cost cutting measure which may jeopardize patient safety and standards of health care.
References

20. THOMSEN HS, MORCOS SK. In which patients should serum creatinine be measured before iodinated contrast medium administration? Eur Radiol 2005;15:749-54.
35. BUSH WA. Update on Metformin (Glucophage®) Therapy and the Risk of Lactic Acidosis: Change in FDA-approved Package Insert. ACR Bulletin 1998;54.
37. RADIOLGISTS TRAANZCO. Guidelines for Metformin Hydrochloride and Intravascular Contrast Media, 2003 (vol 2006).
TELEMEDICINE

COLLEGE POLICY
The College recognizes the value of telemedicine and, in particular, the way in which it enables patients to have greater access to care. ‘Telemedicine’ has been defined as “the use of telecommunications technologies to create audio/visual linkages between physicians and patients in different locations, in actual or stored time.”

Telemedicine provides physicians with another means to interact with patients but it does not modify any of the practice expectations that apply to a physician-patient relationship. This means the College expects physicians practicing telemedicine to:

• Be in accord with established clinical practice standards;
• Use technology that is of sufficient quality to enable the physician to provide quality care; and
• Ensure that patient information remains confidential (for example, ensure the locations of the physician and patient are secure, and the lines of communication are protected from interference).

One of the ways to ensure that the technology is of sufficient quality and the practice environment is secure is to carry out telemedicine sessions within a facility accredited by the Ontario Telemedicine Network.

The College recognizes that telemedicine enables physicians to deliver health services across provincial/territorial and international borders. In many cases, physicians in Ontario refer patients or provide patients’ information to a specialist located outside of the province. Where this occurs and the physician outside of the province is not registered with the CPSO, the College expects the physician in Ontario to inform the patient of that fact and that any potential complaint would need to be considered outside of the province (for example, in the jurisdiction of the specialist).

Providing this information is part of the process for obtaining the patient’s informed consent to the medical consultation.

For Ontario physicians providing care to patients outside of the province via telemedicine, the College suggests that they:

• comply with the licensing requirements of any province/territory/country in which they are providing medical services; and
• in addition, understand that the College maintains jurisdiction over its members wherever they may practice and therefore is required to review any complaint made to it about a member, even if made by a patient located in another jurisdiction. This is based on the principle that patients must be protected from harm and physicians held accountable for the quality of services they perform. Ontario physicians with a certificate of registration in another jurisdiction should also be aware that the College may review concerns arising in the other jurisdiction and may take action with respect to the physician’s certificate of registration in Ontario.

Telemedicine is in a constant state of evolution as technology provides endless opportunities for developing new approaches to the delivery of health services. In recognizing the tremendous potential for growth in this area, the College acknowledges that telemedicine will likely be one of the greatest influences on the way medicine is practiced in the future. For this reason, the College will continue to monitor future developments and provide additional information, in particular, on jurisdictional issues and certificates of registration. It also views telemedicine as an impetus for the future development of a national medical registry.

For questions regarding telemedicine practice, physicians may contact the Physician Advisory Service at the College or the Ontario Telemedicine Network for information. They are also advised to contact a lawyer for any legal advice.

INTRODUCTION
There are potential risks in the MR environment, not only for the patient, but also for the accompanying family members, attending health care professionals, and others who find themselves only occasionally or rarely in the magnetic fields of MR scanners, such as security or housekeeping personnel, firefighters, police, etc. There have been reports in the medical literature and print media detailing MRI adverse incidents involving patients, equipment, and personnel that spotlighted the need for a safety review by an expert panel. The following is the combined paper of 2 reports issued by the American College of Radiology Blue Ribbon Panel on MR Safety, chaired by Emanuel Kanal, MD, FACR. The panel originally met in November 2001 and was charged with reviewing the existing MR safe practices and guidelines and issuing new ones as appropriate for MR examinations. The panel consisted of the following members: A. James Barkovich, MD, Charlotte Bell, MD (Anesthesia Patient Safety Foundation), James P. Borgstede, MD, FACR, William G. Bradley, MD, PhD, FACR, Joel Felmlee, PhD, Jerry W. Froelich, MD, Ellisa M. Kaminski, RT(R)(MR), Emanuel Kanal, MD, FACR, Elaine K. Keeler, PhD (NEMA), James W. Lester, MD, Elizabeth Scoumis, RN, BSN, Loren A. Zaremba, PhD (FDA), Jeffrey Hayden (ACR staff), and Marie D. Zinninger (ACR staff). Upon Dr Keeler’s retirement, Shawn Etheridge was appointed to represent NEMA.

After reviewing substantial feedback from the field and installed base, as well as changes that had transpired throughout the MR industry in the interim, the panel reconvened in 2002 and 2003 and agreed to several modifications and updates to the original document.
The following MR safe practice guidelines document, which incorporates both prior papers, is intended to be used as template for MR facilities to follow in the development of an MR safety program. These MR safe practice guidelines were developed to help guide MR practitioners regarding these issues and to provide a basis for them to develop and implement their own MR policies and practices. It is intended that these MR safe practice guidelines (and the policies and procedures to which they give rise) be reviewed and updated on a regular basis as the field of MR safety continues to evolve.

This white paper does not attempt to deal with all aspects of MR safety, but rather those that apply to an already installed, active site, whether a clinical or research facility. With the increasing advent and use of 3.0-T and higher strength magnets, users need to recognize that one should never assume MR compatibility or safety information about a device if it is not clearly documented in writing. Decisions based on published MR safety and compatibility claims should recognize that all such claims apply only to specifically tested conditions, such as static magnetic field strengths, static gradient magnetic field strengths and spatial distributions, and the strengths and rates of change of gradient and radiofrequency (RF) magnetic fields.

Finally, there is a whole host of other issues that should be considered during the site-planning stages and that is not dealt with in this manuscript. These include, among many others, cryogen emergency vent locations and pathways, 5-G line–siting considerations, patient access pathways, and considerations regarding fringe field blooming that may result in the event there is a failure of an actively shielded MRI system. These issues, and many others, should be reviewed with those experienced in MR site planning and familiar with the patient safety and patient flow considerations prior to committing construction to a specific site design. In this regard, enlisting
the assistance of an architectural firm experienced in this area, and doing so early in the design stages of the planning process, may prove most valuable.

It remains the intent of the ACR that these MR safe practice guidelines will prove helpful as the field of MRI continues to evolve and mature, providing MR services that are among the most powerful, yet safest, of all diagnostic procedures to be developed in the history of modern medicine.
Appendix II  MR Safety

The following safety forms are taken from the ACR White Paper on MR Safety and are used as examples of basic screening tools.

Safety Screening Form for MR Procedures

Reprinted with permission of the American Roentgen Ray Society, Leesburg, Virginia

Date:________ Name:(first/middle/last):_________________________
Female [ ] Male [ ] Age:____ Date of Birth:_________ Height:_______ Weight:__________

1. Why are you having this examination (medical problem?)
2. Have you ever had an MRI examination before and had a problem?    ____        ____
   If Yes, please describe___________________________________
3. Have you ever had a surgical operation or procedure of any kind?                 ____         ____
   If Yes, list all prior surgeries and approximate dates:
4. Have you ever been injured by a metal object/foreign body (e.g. bullet, BB, shrapnel)?  ____         ____
   If Yes, Please describe:___________________________________
5. Have you ever had an injury from a metal object in your eye?
   metal slivers, metal shavings, other metal objects?      ____          ____
   If Yes, did you seek medical attention?      ____          ____
   Describe what was found:_________________________________
6. Do you have a history of kidney disease, asthma, or other allergic respiratory disease?    ____          ____
7. Do you have any drug allergies?        ____           ____ If yes, please list drugs:___________________________________
8. Have you ever received a contrast agent/x-ray dye used for MRI, CT, or other x-ray or study? ____           ____
9. Have you ever had an x-ray dye or magnetic resonance Imaging (MRI) contrast agent allergic reaction?
   If Yes, please describe:___________________________________
10. Are you pregnant or suspect you may be pregnant?      ____          ____
11. Are you breast feeding?        ____          ____
12. Date of last menstrual period       ____           ___
   Post-menopausal?         ____          ____

MR Hazard Checklist

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The following items may be harmful to you during your MR scan or may interfere with the MR examination. Please mark on the chart below the location of any metal inside your body or site of surgical operation.

You must provide a Yes or No for every item. Please indicate if you have ever had any of the following:

<table>
<thead>
<tr>
<th></th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any type of electronic, mechanical, or magnetic implant (Type:_______________________________________)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cardiac pacemaker</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aneurysm clip(s)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Implanted cardiac defibrillator</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neurostimulator</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Item</td>
<td>Type/Description</td>
<td></td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Biostimulator</td>
<td>Type: ______________________________</td>
<td></td>
</tr>
<tr>
<td>Any type of internal electrode(s) or wire(s)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cochlear implant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hearing aid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Implanted drug pump (e.g. insulin, Baclofen, chemotherapy, pain medicine)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Halo vest</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spinal fixation device</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spinal fusion procedure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any type of coil, filter, or stent (Type:_________________)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any type of metal object (e.g. shrapnel, bullet, BB)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Artificial heart valve</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any type of ear implant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Penile implant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Artificial eye</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eyelid spring</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any type of implant held in place by a magnet (Type:_________________)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any type of surgical clip or staple</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any IV access port (e.g. Broviac, Port-a-Cath, Hickman, Picc line)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medication patch (e.g. Nitroglycerine, nicotine)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shunt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Artificial limb or joint (What and where:___________________________)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tissue expander (e.g. breast)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Removable dentures, false teeth or partial plate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diaphragm, IUD, Pessary (Type:_________________)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surgical mesh (Location:_________________________)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Body piercing (Location:_________________________)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wig, hair implants</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tattoos or tattooed eyeliner</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radiation seeds (e.g. cancer treatment)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any implanted items (e.g. pins, rods, screws, nails, plates, wires)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any hair accessories (e.g. bobby pins, barrettes, clips)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jewelry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any other type of implanted item (Type:_________________)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

I attest that the above information is correct to the best of my knowledge. I have read and understood the entire contents of this form and I have had the opportunity to ask questions regarding the information on this form.

Patient signature: ___________________________  MD/RN/RT signature:__________________
Date:_________  Print name of MD/RN/RT_______________________________

College of Physicians and Surgeons of Ontario
Patient Instructions

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1. You are urged to use the ear plugs or headphones that we supply for use during your MRI examination since some patients may find the noise levels unacceptable and the noise levels may affect your hearing.

2. Remove all jewelry (e.g. necklaces, pins, rings)

3. Remove all hairpins, bobby pins, barrettes, clips etc.

4. Remove all dentures, false teeth, partial plates

5. Remove all hearing aids

6. Remove eyeglasses

7. Remove your watch, pager, cell phone, credit and bank cards, and all other card with a magnetic strip

8. Remove body piercing objects

9. Use gown, if provided, or remove all clothing with metal fasteners, zippers

Hazard checklist for MRI Personnel

Reprinted with permission of the American Roentgen Ray Society, Leesburg, Virginia

For MRI Office Use only

Patient Name___________________________________________
Patient ID Number_________ Referring Physician__________
Procedure________________________________________________
Diagnosis_____________________________
Clinical History___________________________

Hazard Checklist for MRI Personnel:

Endotracheal tube YES NO
Swan-Ganz catheter
Extraventricular device
Arterial line transducer
Foley catheter with temperature sensor and/or metal clamp
Rectal probe
Esophageal probe
Tracheotomy tube
Guidewires
Appendix III  Sample MRI Requisition

The following requisition is a sample, copied with permission from the Rouge Valley Health System in Scarborough, Ontario.

**Patient Information**

Name: (first/last) _____________________

Address: ____________________________

Postal Code: _________________________

DOB (D/M/Y): ________________________

Room #: __________ Male [ ] Female [ ]

Outpatient [ ] or Inpatient [ ]

Inpatient from other hospital [ ]

Other Hospital: _______________________

Health Card # _______________________

version: ____________________________

Telephone - Home (___) ____________
    - Work (___) ____________________

Mode of transport:

walking [ ]

wheelchair [ ]

stretcher [ ]

Is this a WSIB examination? Yes [ ] No [ ]

Claim #: ___________________________

**Imaging Protocol (radiologist Use)**

Priority Code 1 2 3 4

Monitor: Yes [ ] or No [ ]

Protocol Code _______________________

Protocol Details _____________________

Gadolinium: Yes [ ] or No [ ] Dose: ________________

Area to be examined (please be specific):

Clinical Information________________

Working Diagnosis:__________________

**Referring Physician Information**

Name: ____________________________ Address: ____________________________
Other Tests and Results to Date
MRI: __________________________
CT: __________________________
X-ray: _______________________  
US: _________________________
Myelogram:____________________
Angiogram:___________________
Nuclear Medicine:____________
Arthrography:________________

Does the Patient require sedation (to be provided by the referring physician)?  
Yes [ ] or No [ ]

See other side for Patient Screening section to be completed by a referring physician

Patient Screening

(must be completed by a referring physician)

Please check Yes or No Yes No
1. Have you ever worked with metal?
2. Has metal ever gone into your eye?
3. Could you be pregnant?
4. Do you have any of the following?
   - cardiac pacemaker/leads
   - artificial cardiac valve
   - aneurysm clips
   - neurostimulator
   - Cochlear implants
   - shrapnel/bullets
   - Porta Cath
   - dentures/braces
   - other implanted devices______________________________________
5. Have you ever had surgery on your:
   - head?
   - neck?
   - spine?
   - chest?
   - abdomen?
   - arms/legs?
6. What is your current weight_____________________________{(maximum allowable weight: 350 lbs/159 kg)}

-Referring Physicians: If the answer is YES to questions 1 or 2, please order x-ray of the Orbits on the patient and submit the report with this requisition.

If Yes to any part of section 4 or 5, please provide details below:

Referring MD Signature: ____________________________
Appendix IV  Recommended Guidelines for Preventing Allergic Reactions to Natural Rubber Latex

Definition

Natural latex is a milky fluid obtained from the hevea braziliensis (rubber) tree found in Africa and South-east Asia. Various chemical agents such as vulcanizers, accelerators, stabilizers and anti-oxidants are added natural latex.

Background

The latex allergy is an enormous public health problem faced by health care workers and patients. Healthcare workers have become the fastest group to experience latex sensitivity and more often its adverse affects.

Latex is a common component in health care products and consumer products. In 1989 there were 400 reported anaphylactic reactions and 15 deaths due to latex contact. The implementation of universal precautions in 1987, to prevent HIV and other blood borne pathogens infections resulted in an increased demand for gloves. Manufacturing processes may have temporarily changed to meet this dramatically increased demand for gloves, resulting in latex products with higher allergic and irritant properties being produced and used. Repeated exposure to latex products can cause hypersensitivity reactions locally and systemically. Reducing exposure to latex products will definitely decrease sensitization and symptoms. There is no treatment for latex allergy except complete avoidance of latex.

Goals in Management

The two major goals in the management of latex reactions are successful identification and treatment of all dermatitis, to prevent future sensitization and identification of latex allergy to prevent serious life treating sequelae whenever possible.

Types of Reactions to Latex

Irritant Contact Dermatitis (most common type of reaction)

Not an allergic reaction involving the immune system but rather a skin irritation caused by the chemicals added to the latex during the manufacturing of the glove powder itself, repeated irritation from sweating under the gloves or from gloves rubbing against the hands, characterized by dry, flaky skin and papules, redness, fissures an thickening of skin.
Allergic Contact Dermatitis: Type IV

- Delayed type hypersensitivity
- A cell-mediated allergic reaction to the chemicals used during the processing of latex. The more common sensitizers/allergens are thiurams and carbamates (accelertors)
- Results from prolonged contact with these chemicals in gloves
- Symptoms usually appear 6 to 48 hours after exposure
- Characterized by localized redness, clustered vesicles, swelling, itching, cracking eczema and fingertip fissures

Immediate Allergic Reaction: Type I

- An immediate immunoglobulin E mediated allergic response to the latex protein themselves
- Reaction usually occurs 5 to 30 minutes after exposure
- The response is introduced by direct contact with latex on non-intact skin resulting in sensitization before manifesting as a generalized reaction
- Once sensitivity has been initiated, any contact with latex may cause a recurrence of the reaction
- The protein allergens have been found in water-soluble extracts from latex rubber film. It may also be absorbed by glove powder, which may become airborne
- The severity of the immediate reaction will depend in the route of exposure; cutaneous, mucosal, inhalation and parenteral, the amount of latex allergen and the degree of individual sensitivity
- Mild reactions involve skin redness-hives-itchiness
- More severe reactions may imply edema, itching, conjunctivitis around the eyes, rhinitis, nasal itching, sneezing, shortness of breath, asthma, airway obstruction due to bronchospasm, anaphylactic shock

Risk Factors for Latex Sensitivity and Allergy

- Persons with spina bifida
- Patients and congenital urogenital defects, history of indwelling urinary catheters or repeated catheterizations
- Patients who have undergone recurrent surgical procedures
- Workers with ongoing latex exposure – health care workers, housekeepers, food handlers, tire manufacture workers, workers in industry who use gloves regularly
- Atopic individuals – persons with multiple allergic conditions, eczema, asthma, rhinitis
Individuals allergic to certain food, banana, avocado, chestnut, apricot, kiwi, papaya, passion fruit, pineapple, peach, nectarine, plum, cherry, melon, fig, grape, potato, tomato and celery may cause a cross reactivity with latex protein

No treatments are available to cure latex allergy. The best treatment is to avoid exposure. The treatment for individual allergic to latex is to ensure a safe environment. Medications are available to alleviate the allergy symptoms

Recommendations

Patients

- All patients are assessed for adverse reactions or contraindicated substance during their admission assessment. We should provide a latex safe environment for patients allergic and sensitive to latex.
- History for presence of allergies such as hay fever, childhood or adult eczema, asthma and food allergies
- Multiple surgeries
- Undiagnosed reactions or complications during surgery anesthesia or dental work – angioedema, shortness of breath, rash
- History of latex exposure: type of latex device, nature and duration of exposure
- History of latex allergy such as cutaneous symptoms (dermatitis-eczema-urticaria) respiratory symptoms, (rhinitis, wheezing, coughing, sneezing, shortness of breath)
- Any respiratory symptoms experienced when in contact with products containing rubber
- Other systems such as itchy hands, conjunctivitis, localized angioedema, possible systemic anaphylactic symptoms with the use of household latex cleaning gloves, balloons, condoms and diaphragms
- If a patient has any of the above categories the following measure should be taken:
  - Patients with severe documented allergy to latex should be assessed for the need of a private room
  - A cart containing all latex free supplies that are necessary for patient care from admission to discharge. This cart will follow patient to other departments
  - Wear non-latex examination and sterile gloves. Vinyl gloves should be changed every 15 minutes to protect the health care worker from borne pathogens
  - Identify chart, patient, bed, medication profile, kardex, physicians order sheet with latex allergy stickers
  - Post latex allergy sign on patient’s door
• Wear a cover gown if the possibility that our uniform contains residues of powder from latex gloves
• Tape over IV tubing ports and do not use
• Do not inject via T-connectors, buritrol or IV bag, inject and administer medication only through plastic stopcock
• Remove stoppers from vial then draw up medication. Needle puncturing a rubber stopper can shear off particles of latex, and cause a systemic reaction
• Glass syringe or latex free syringe must be used, if plastic syringe are used, the solution must be injected immediately after being drawn up
• If pulse oximetry is used, cover finger with tegaderm then apply probe. The inside surface of most pulse oximeters is covered with latex
• Avoid skin contact with the bulb and tubing of the blood pressure cuff by placing cloth under the rubber to shield the skin
• Stethoscope tubing can be covered with a stockinette
• If catheterization is necessary, use silastic foley catheter
• Utilize single dose ampoules for parenteral medication
• Patients that are highly reactive may require medications at the bedside. Epinephrine should be available if an anaphylactic shock occurs
• If the patient develops an allergic reaction, remove suspected allergen and provide immediate care
• All staff interacting with this patient must follow proper hand washing procedures before caring for these patients in order to minimize the exposure to and transfer of latex protein

Health Care Workers

• Health care workers should protect themselves from latex exposure and allergy in the workplace:
• Use non-latex gloves for activities that do not involve contact with blood or body fluid
• For activities where contact with infectious materials is expected and latex gloves are used, choose a reduced protein, powder free glove
• Workers with hand dermatitis should never wear oil hand cream or lotion with latex gloves. Oil breaks down latex, damages the glove barrier and releases additional allergen. Detergents and other chemicals also degrade latex gloves
• After removing gloves, wash hands with soap and dry thoroughly, never re-use glove
• If you experience any symptoms possibly related to latex allergy, report it to Health and Safety Department, avoid contact with latex gloves until you see your allergist
• Attend latex allergy education session
• If allergic to latex:
  • Avoid contact with latex gloves, latex containing products and objects such as computer keyboards, telephones, that have been contaminated with latex gloves or glove powder
  • Avoid areas where you might inhale the powder from latex gloves worn by other workers
  • Wear medical alert bracelet
• Attend latex allergy education session
• Carry an emergency epinephrine auto-injector
• Avoid cross-reacting food such as: kiwi, avocado, chestnut
• Follow your physician’s instructions for dealing with allergic reaction to latex

**Institution**

• To eliminate or reduce the risk for latex sensitization of asymptomatic staff and minimize the risk of latex exposure to staff already sensitized:
  • Eliminate unnecessary use of latex gloves by providing workers with non-latex gloves when there is minimal potential for contact with blood or bodily fluid
  • When selecting a latex glove for barrier protection from infectious materials, choose a reduced protein, powder free glove. Glove should be approved by the Canadian General Standard Board
  • Provide education to employees about latex allergies, hand care and the importance of early care for dermatitis or other allergy symptoms. Identify and instruct worker in work practices to prevent exposure
  • Implement a latex allergy assessment protocol including a screening history questionnaire and protocol of evaluation and treatment of latex reaction symptoms
  • Conduct a worksite evaluation, identify areas contaminated with latex dust and make sure cleaning is done more frequently. Ensure that filtration and ventilation systems provide adequately re-circulated air in area with high levels of latex aerosols
  • Alternative latex free devices must be available
  • Identification of medical product containing latex
  • Incorporate latex allergy education as part of the annual safety and infection control program, orientation program and also conduct in services
Once a diagnosis of latex allergy is confirmed, the employee should accommodate the affected workers. Extremely sensitive individuals may have to be re-assigned to areas where no latex gloves.
Appendix V  Sample Latex Allergy Questionnaire

Overview
A sample Latex Allergy Questionnaire is provided on the following pages.

Latex Allergy Questionnaire

I. Risk Factor Assessment
Please circle Y or N to answer the following questions

Exposure History:
Are you a health care worker? Y N
Do you wear latex gloves regularly or are you otherwise exposed to latex regularly? Y N
Do you have a history of eczema or other rashes on your hands? Y N
Do you have a medical history of frequent surgeries or invasive medical procedures? Y N
Did these take place when you were an infant? Y N
Do you have a history of “hay fever” or other common allergies? Y N
Do your fellow workers wear latex gloves regularly? Y N
Do you take beta-blocker medication? Y N

List any foods below that cause hives, itching of the lips or throat, or more severe symptoms when you eat or handle them:

II. Contact Dermatitis Assessment
For patients who wear latex gloves frequently
Do you have rash, itching, cracking, chapping, scaling, or weeping of the skin from latex glove use? Y N
Have these symptoms recently changed or worsened? Y N
Have you used different brands of latex gloves? Y N

II. Contact Dermatitis Assessment cont’d
If so, have your symptoms persisted? Y N
Have you used non-latex gloves? Y N
If so, have you had the same or similar symptoms as with latex gloves? Y N
Do these symptoms persist when you stop wearing all gloves? Y N

III. Contact Urticaria (Hives) Assessment
For patients who wear latex gloves frequently
When you wear or are around others wearing latex gloves do you get hives, red itchy swollen hands within 30 minutes or, “water blisters” on your hands within a day?  

<table>
<thead>
<tr>
<th>Y</th>
<th>N</th>
</tr>
</thead>
</table>

**IV. Aerosol Reaction Assessment**

When you wear or are around others wearing latex gloves, have you noted any of the following:

<table>
<thead>
<tr>
<th>Itchy, red eyes, fits of sneezing, runny or stuffy nose, itching of the nose or palate?</th>
<th>Y</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shortness of breath, wheezing, chest tightness or difficulty breathing?</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Other acute reactions, including generalized or severe swelling or shock?</td>
<td>Y</td>
<td>N</td>
</tr>
</tbody>
</table>

**V. History of Reactions Suggestive of Latex Allergy**

<table>
<thead>
<tr>
<th>Do you have a history of anaphylaxis or of intra-operative shock?</th>
<th>Y</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have you had itching, swelling or other symptoms following dental, rectal or pelvic exams?</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Do condoms, diaphragms or latex sexual aids cause itching or swelling?</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Do rubber handles, rubber bands or elastic bands or clothing cause any discomfort?</td>
<td>Y</td>
<td>N</td>
</tr>
</tbody>
</table>
Appendix VI  Sample Patient Survey: Quality of Care

Please rate the following things about your visit to this clinic in terms of whether they were poor, fair, good, very good, or excellent. Circle the number 1 for poor; 2 for fair; 3 for good; 4 for very good, and 5 if you felt it was excellent. If something doesn’t apply to your visit or you don’t have an opinion, please circle the number 8.

<table>
<thead>
<tr>
<th>Please rate each item by circling the number that best describes your opinion</th>
<th>Poor</th>
<th>Fair</th>
<th>Good</th>
<th>Very Good</th>
<th>Excellent</th>
<th>Not Applicable No Opinion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Waiting time: how long you had to wait to get an appointment at this clinic</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>2. Waiting time: how long you had to wait in the clinic waiting room for your appointment</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>3. Instructions: how well the clinic staff (doctors, receptionists, technologists etc.) told you how to prepare for the test(s) and what to expect both before and/or during the test(s)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>4. Ease of getting information: willingness of clinic staff to answer your questions</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>5. Information you were given: how clear and complete the explanations were about any possible risks and complications of the test(s)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>6. Concern and caring by clinic staff: courtesy and respect you were given, friendliness and kindness; how well clinic staff listened to what you had to say; how well the clinic staff understood what you thought was important</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>7. Safety and security: the provisions for your safety and the security of your belongings</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>8. Privacy: how well your privacy was considered, for example, type of gowns used, privacy while changing clothes</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>9. Instructions on leaving: how clearly and completely you were told what to do and what to expect when you left the clinic</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>Question</td>
<td>YES</td>
<td>NO</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>-----</td>
<td>----</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Were you told to leave the clinic before you felt ready to do so?</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Did you have to visit a physician, walk-in clinic, emergency room,</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>urgent care centre or hospital in the days following this service</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>because your health got worse as a result of the service(s) received at</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>the clinic?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Would you recommend the clinic to a friend or family member if they</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>needed services that it provides?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Please rate this item by circling the number that best describes your opinion**

<table>
<thead>
<tr>
<th>Poor</th>
<th>Fair</th>
<th>Good</th>
<th>Very Good</th>
<th>Excellent</th>
<th>Not Applicable No Opinion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>13. Overall quality of care: how you evaluate the services you</td>
<td></td>
</tr>
<tr>
<td>received and the way you were treated</td>
<td></td>
</tr>
<tr>
<td>14. If there were some things you could change about this visit to</td>
<td></td>
</tr>
<tr>
<td>improve it, what would they be?</td>
<td></td>
</tr>
</tbody>
</table>

Thank you for completing this survey. Please double check that you have answered all questions and then place the survey in the envelope provided. Your answers will be kept completely confidential.

Thank you again for your help!
Appendix VII  Sample Referring Physician Survey-Independent Health Facilities Program

*name of facility*

Please answer the following questions regarding your experience with the above facility by filling in the blank or circling the number that best describes your answer.

1. How long have you referred patients to this facility? _______ years or _______ months

*Please base your answers on your contact with the facility in the past 6 months.*

2. How satisfied are you with how long it generally takes: (Please rate each item by circling the number that best describes your opinion)

<table>
<thead>
<tr>
<th></th>
<th>Not Applicable</th>
<th>Very Dissatisfied</th>
<th>Dissatisfied</th>
<th>Neutral</th>
<th>Satisfied</th>
<th>Very Satisfied</th>
</tr>
</thead>
<tbody>
<tr>
<td>to get an appointment for a patient at this facility?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>to obtain written results (a written consultation) from this facility, once your patient is seen?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>to get an oral report from this facility when it is required because of an urgent or emergency situation, once your patient is seen?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

3. How often do you speak to a physician at the IHF regarding the patient’s clinical condition before your patient receives a diagnostic work-up?

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Rarely</th>
<th>Occasionally</th>
<th>Sometimes</th>
<th>Often</th>
<th>Almost all the time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

4. Approximately how many patients have you referred to this facility in the past 6 months? ___________ (number of patients referred)

5. Do you refer your patients to more than one facility of this type?

   1  No (if you circled No, please skip to Question number 7)
   2  Yes

6. What are the reasons you refer patients to this particular facility?
(Please circle all that apply.)
1 Nearer Patient’s home
2 Has specialized equipment needed for test requested
3 Turn around time to receive the results is shortest
4 Has staff that speak other languages, and thus can better understand my patients
5 Is able to quickly see patients when feedback is urgently required
6 Has convenient hours of operation
7 Quality of the services provided
8 Other, please describe ____________________

Please skip to Question number 8.

7. What are the reasons you refer patients only to this facility? (Please circle all that apply.)

1 Only facility of its type in this community
2 Our group has a service contract with this facility
3 Facility is located near this practice and is thus convenient for patients
4 Has staff that speak other languages and thus can better understand my patients
5 Has specialized equipment needed for tests requested
6 Turn-around time to receive results is short
7 Nearest patients’ homes
8 Is able to quickly see patients when feedback is urgently required
9 Quality of the services provided
10 Has convenient hours of operation
11 Other, please describe____________________

8. Please rate each item by circling the number that best describes your experience with the IHF based on your contacts in the last 6 months.

<table>
<thead>
<tr>
<th>The waiting period for a test to be done is long.</th>
<th>Never</th>
<th>Seldom</th>
<th>Sometimes</th>
<th>Frequently</th>
<th>Usually</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requests for consultation are handled promptly.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The facility accommodates patients when the test is urgently required.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The interpreting physician is available to you for consultation.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>This facility meets the needs of my patients whose first language is other than English or French.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The recommendations received are useful in patient management. 

The recommendations are clearly stated.

The reports received are too wordy.

Reports of results are sent out in a timely fashion.

The consulting physician orders tests in addition to those you requested.

When tests are added the resulting recommendations add information important to patient care.

The interpreting physician's findings are generally consistent with your clinical findings.

9. Have you been dissatisfied with a consult you received from this facility in the past six months? 1 No 2 Yes
   If 2 (Yes), please explain:

10. Overall, how satisfied are you with the contacts you have had with this facility in the past six months?

   Very Dissatisfied Neutral Satisfied Very Satisfied
   1 2 3 4

Thank you for participating in this survey. Please return the survey in the envelope provided.

Our address is:
Appendix VIII  Independent Health Facilities Act
- Ontario Regulation 57/92 -
Amended to O. Reg. 14/95

Note:  Ontario Regulation 57/92 has previously been amended. Those amendments are listed in the Table of Regulations - Legislative History Overview which can be found at www.e-laws.gov.on.ca. Facilities are encouraged to check the Government Website for updates.

Quality Advisor and Advisory Committee

1(1) Every licensee shall appoint a quality advisor to advise the licensee with respect to the quality and standards of services provided in the independent health facility.
(2) If the quality advisor dies or ceases to be the quality advisor, the licensee shall appoint a new quality advisor forthwith.
(3) The quality advisor must be a health professional who ordinarily provides insured services in or in connection with the independent health facility and whose training enables him or her to advise the licensee with respect to the quality and standards of services provided in the facility.
(4) It is a condition of a licence that the quality advisor be a physician if all the insured services provided in the independent health facility that support the facility fees that the licensee may charge are provided by physicians.
(5) In subsection (4), an insured service supports a facility fee if the facility fee is for or in respect of a service or operating cost that supports, assists or is a necessary adjunct to the insured service.
(6) A licensee who is qualified under subsection (3) may appoint himself or herself as the quality advisor only if there is no other health professional who is qualified to be the quality advisor who will consent to be the quality advisor. O Reg 57/92, s.1.

2(1) Every licensee shall appoint an advisory committee to advise the quality advisor.
(2) The advisory committee shall consist of health professionals who provide health services in or in connection with the independent health facility.
(3) The quality advisor shall be the chair of the advisory committee.
(4) Every licensee shall use his or her best efforts to ensure that there is a representative on the advisory committee from the health profession and each specialty and sub-specialty of medicine, practitioners of which provide health services in or in connection with the independent health facility. O Reg. 57/92, s.2.

3(1) Every licensee shall give the Director the name of the quality advisor in writing forthwith after the quality advisor is appointed.
(2) If the quality advisor dies or ceases to be the quality advisor, the licensee shall inform the Director in writing forthwith.
(3) Every licensee shall give the Director, on request, the names of the members of the advisory committee in writing. O. Reg. 57/92, s.3.
Standards

4 (1) Every licensee shall ensure that all aspects of the services provided in the independent health facility are provided in accordance with generally accepted professional standards.

(2) Every licensee shall ensure that the persons who provide services in the independent health facility are qualified, according to generally accepted professional standards, to provide those services.

(3) If the quality advisor has reasonable grounds to believe that this section is not being complied with, he or she shall inform the Director forthwith. O. Reg. 57/92, s.4.

5 Every licensee shall keep a system to monitor the results of the services provided in the independent health facility. O. Reg. 57/92, s.5.

6 (1) Every licensee shall ensure that all tissues removed from a patient during an operation or curettage performed in an independent health facility are sent to a laboratory for examination and report unless the physician performing the operation or curettage is of the opinion that it is not necessary according to generally accepted medical standards.

(2) The licensee shall ensure that a short history of the case and a statement of the findings of the operation or curettage are sent with the tissues. O. Reg. 57/92, s.6.

Records of Employees

7 (1) Every licensee of an independent health facility shall maintain, for each employee of the facility who is not a physician, an employment record setting out the employee’s qualifications and employment history including a record of any registration with or licensing by the governing body of a health profession.

(2) Every licensee shall retain an employee’s employment record for at least two years after the employee ceases to be an employee. O. Reg. 57/92, s.7.

8 (1) Every licensee of an independent health facility shall maintain a record of qualifications and work history for:

   (A) each person the licensee contracts with to manage the facility; and
   (B) each person who is not a physician who the licensee contracts with to provide patient-related services in the facility.

(2) The record shall include a record of any registration with or licensing by the governing body of a health profession.

(3) Every licensee shall retain the record for a person the licensee contracts with for at least two years after the licensee ceases to contract with the person. O. Reg. 57/92, s.8.

9 (1) Every licensee shall maintain a declaration of professional standing for each physician who provides professional services in the independent health facility.

(2) A declaration of professional standing must include the following information:

   1. The physician’s name
   2. The physician’s registration number with the College of Physicians and Surgeons of Ontario
   3. The physician’s number registered with the Health Insurance Division of the Ministry of Health.
4. The class of the physician’s licence issued under Part III of the Health Disciplines Act and any terms and conditions attached to it.
5. The physician’s specialty.

(3) Every licensee shall give the Director a copy of each declaration of professional standing, forthwith after the obligation to maintain it begins under subsection (1).
(4) Every licensee shall give the Director a written statement of any change in a declaration of professional standing forthwith after the change.
(5) Subsections (3) and (4) do not apply with respect to physicians providing services on a temporary basis for less than twelve weeks. O. Reg. 57/92, s.9.

**Patient Records**

10 (1) Every licensee of an independent health facility shall keep, for each person who is or was a patient, a health record relating to the health services provided in the facility.
(2) A patient’s health record must include:
   (a) the patient’s name and home address
   (b) the patient’s date of birth
   (c) the patient’s health number
   (d) the name of any attending physician or practitioner and his or her number as registered with the Health Insurance Division of the Ministry of Health
   (e) the name of any referring physician or practitioner and his or her number as registered with the Health Insurance Division of the Ministry of Health
   (f) a history of the patient
   (g) a written record of any orders for examinations, tests, consultations or treatments
   (h) particulars of any examination of the patient
   (i) any reports of examinations, tests or consultations including any imaging media from examinations and any physicians’ interpretive or operative reports
   (j) any reports of treatment including any physicians’ operative reports
   (k) any orders for and reports of any discharge of the patient from supervised care
   (l) any consents; and
   (m) any diagnoses of the patient.
(3) A patient’s health record need not contain a history of the patient if the patient came to the independent health facility for diagnostic services only and received on such service.
(4) Every licensee shall ensure that every part of a patient’s record has a reference on it identifying the patient or the record.
(5) If information in a patient’s record is kept in the form of a chart, each entry in the chart must be dated and it must be initialled by the person authorizing the entry. O. Reg. 57/92, s.10.

11 (1) Every licensee shall retain a patient’s health record or a copy of it for at least six years following:
   (a) the patient’s last visit; or
   (b) if the patient was less than eighteen years old when he or she last visited the facility, the day the patient became or would have become eighteen years old.
(2) Despite subsection (1), a licensee is not required to retain imaging media from any examination other than a mammography for more than three years following:
   (a) the patient’s last visit; or
   (b) if the patient was less than eighteen years old when he or she last visited the facility, the day the patient became or would have become eighteen years old.

(3) Every licensee shall retain the film from a mammography for at least ten years following the patient’s last visit. O. Reg. 57/92, s.11.

(4) On the transfer of a licence under section 11 of the Act, the transferor of the licence shall transfer to the transferee of the licence, in a manner that will protect the privacy of the records, the records maintained under section 10 of this Regulation, and the transferee of the licence shall retain those records in accordance with this section.

Section 12 of the Regulation is revoked and the following substituted:

12 (1) No licensee shall allow any person to have access to any information concerning a patient that is not subject to the Personal Health Information Protection Act, 2004 except in accordance with subsection (3).

(2) The reference to “information concerning a patient” in subsection (1) includes information or copies from a health record, even if anything that could identify the patient is removed.

(3) A licensee may provide information described in subsection (1) to the following persons if anything that could identify the patient is removed from the information:
   1. Any person, if the information is to be used for health administration or planning or health research or epidemiological studies and the use is in the public interest as determined by the Minister.
   2. Cancer Care Ontario. O Reg. 346/04, s.2.

Books and Accounts

12.1(1) This section applies to licensees of independent health facilities that are funded under section 24 of the Act, other than independent health facilities whose funding is based solely on the Ministry of Health publication titled “Schedule of Facility Fees”.

(2) Every licensee shall keep the following records in relation to the independent health facility:
   1. Current financial records showing:
      (i) the amounts paid by the Minister to the licensee under section 24 of the Act.
      (ii) the revenue earned by the licensee from facility fees charged by the licensee for or in respect of services or operating costs that support, assist or are a necessary adjunct to the primary insured services set out in the licensee’s licence, and
      (iii) the expenditures, assets and liabilities of the facility that relate to the costs paid by the Minister under section 24 of the Act.
   2. A reporting record listing each service provided in the facility that is a primary insured service set out in the licensee’s licence and each service provided in the facility that is a funded service under section 24 of the Act and showing how many of each of such services are provided.
3. An annual income and expense statement showing the income received and the expenses incurred by the licensee in connection with the services mentioned in paragraph 2.

4. An annual inventory of the assets of the facility that have an acquisition cost exceeding $3,500 and that relate to the costs paid by the Minister under section 24 of the Act.

(3) Every licensee shall ensure that the records required under section (2):
   (a) are kept in the independent health facility; and
   (b) are kept in a bound or loose-leaf book or are recorded by a system of mechanical or electronic data processing or any other information storage device.

(4) Every licensee shall ensure that any part of a record required under subsection (2) that relates to a period of time is retained for at least six years following the end of the period.

(5) Every licensee shall ensure that the accounts of the independent health facility are audited by a person licensed under the Public Accountancy Act. O. Reg. 283/94, s.1, part.

12.2 Every licensee of an independent health facility shall furnish such information and accounts as the Director may require. O. Reg. 283/94, s.1, part.

Notices

13 Every licensee of an independent health facility,
   (a) who decides to cease operating the facility at a future date shall give the Director, as soon as possible, written notice of the date; and
   (b) who ceases operate the facility shall give the Director, within seven days after the date the licensee ceases to operate the facility, written notice of the date. O. Reg. 57/92, s.13.

14 Every licensee of an independent health facility shall give the Director:
   (a) if the licensee is a corporation, written notice of any change in the location of the licensee’s head office within ten days after the change; and
   (b) written notice of any change in the name under which the licensee carries on business within ten days after the change. O. Reg. 57/92, s.14.

Miscellaneous

15 It is a condition of a licence that the licensee post the first page of the licence in a conspicuous place in the independent health facility. O. Reg. 57/92, s.15.

16 (1) The fee for a licence is $100.
   (2) The fee for the transfer of a licence is $100.
   (3) The fee for the renewal of a licence is $100. O. Reg. 57/92, s.16.

17 The administrative charge for the purposes of section 36 of the Act is $50. O. Reg. 57/92, s.17.