MRI Accreditation Program

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ACR MAGNETIC RESONANCE IMAGING (MRI) ACCREDITATION PROGRAM DESCRIPTION

The MRI Accreditation Program is a response to three important factors: a request from the Radiology Summit Meeting (1992) that the ACR develop new accreditation programs, the success of the Mammography Accreditation Program, and the general concern among imaging specialists about the quality of performance of MRI in current practice. The MRI Accreditation Program concept was approved by the ACR Council at the 1994 Annual Meeting and is based on existing ACR Standards.

Designed to be educational in nature, the MRI Accreditation Program evaluates qualifications of personnel, equipment performance, effectiveness of quality control measures, and quality of clinical images. It is believed that these are primary factors which impact the quality of clinical images and the quality of patient care.

A full term of accreditation for an MRI facility is a three year period. The facility receiving ACR MRI Accreditation is awarded a three year certificate recognizing its achievement. A confidential final report is sent to the supervising radiologist or physician of the MRI site at the end of the accreditation process regardless of whether or not it achieves accreditation. This peer review document discusses accomplishments, defines issues which could be improved, and provides recommendations about the performance of magnetic resonance imaging for consideration.

The actual accreditation process for MRI consists of two parts which must be completed successfully in order to receive accreditation. The first part of the process is review of the entry application which elicits information about the credentials of physicians, physicists, and technologists and other information common to the practice of MRI. The second part of the accreditation program involves the acquisition of clinical and phantom images and corresponding data for each. Required clinical images consist of routine brain, cervical spine, lumbar spine, and knee examinations which have been acquired using specific sequences. The acquisition of phantom images involves the use of a designated MRI phantom. The required clinical and phantom images and corresponding data must be obtained from each full body general purpose magnet at the site of MR practice. All the information collected will be utilized in determining accreditation. ACR Accreditation for the Performance of Magnetic Resonance Imaging will be granted to all participants whose accreditation material meet the criteria described in program documents.

Specialty magnets in operation at a site requesting review for accreditation do not qualify for accreditation at this time. Accreditation modules for examinations performed on magnets reserved for specialty examinations such as knee (only) or extremity (only) will be considered in future program development. However, all required images must be submitted from every whole body magnet. A whole body magnet that is used only for knees would not qualify as a specialty magnet. Sites which have achieved accreditation for the practice of general MRI services using general purpose whole body magnets will be notified automatically when additional accreditation modules become available for their specialty magnets.

Generally, information about the MRI Accreditation Program is communicated using the US Mail. However, on-site review and random film checks may be performed at the discretion of ACR officials for validation or clarification. The ACR MRI Accreditation Program is available to all facilities which meet program criteria which have been developed using the existing ACR Standards as a basis.

Information collected from the MRI Accreditation Program will become part of the existing accreditation data base. It is believed that comparison of findings collected from the accreditation program will further the development of quality control information by providing reliable data to use as a basis for improving the quality of performance of magnetic resonance imaging.

BASIC REQUIREMENTS FOR ACR MRI ACCREDITATION

The following criteria (based on the current ACR Standard for the Performance of Magnetic Resonance Imaging) reflect the minimum requirements a facility must meet in order to qualify for ACR MRI Accreditation.

I. QUALIFICATIONS AND RESPONSIBILITIES OF PERSONNEL

A. Physician

The physician shall have the responsibility for all aspects of the study including but not limited to: reviewing all indications for the examination, specifying the pulse sequences to be performed, specifying the use and dosage of contrast agents, interpreting images, generating written reports, and assuring the quality of both the images and interpretations.

Physicians assuming these responsibilities should meet the following qualifications:

1. a. Certification in Radiology or Diagnostic Radiology by the American Board of Radiology, the American Osteopathic Board of Radiology, or the Royal College of Physicians and Surgeons of Canada.

   b. Qualifications may also be fulfilled by radiologists who completed residency training prior to the existence of a defined fellowship in MRI. Such individuals shall have completed residency training prior to 1982 and have been involved with the performance and interpretation of at least 500 MRI examinations.

OR

2. a. Six (6) months training in cross-sectional body imaging to include at least three (3) months training in computed tomography or one (1) year documented experience in cross-sectional body imaging including body CT, as well as interpretation and reporting of these examinations,

   AND

   b. Three (3) months training or six (6) months documented experience in neuroradiology,

   AND

   c. Three (3) months training or six (6) months documented experience in nuclear radiology,

   AND

   d. Three (3) months training or six (6) months documented experience in musculoskeletal radiology.

3. The physicians shall have supervised experience in MRI clinical application, physics, safety, and instrumentation or at least one hundred twenty (120) hours of documented training.

4. The physician's continuing education should be in accordance with the ACR Standard for Continuing Medical Education (CME) and should include CME in MRI as is appropriate to his/her practice needs.

B. Medical Physicist

A qualified medical physicist **should** have the responsibility for overseeing the equipment quality control program and for monitoring performance upon installation and routinely thereafter. Although facilities are **not required** to have the services of a qualified medical physicist at this time, it is strongly recommended.

A Qualified Medical Physicist is an individual who is competent to practice independently one or more of the subfields in medical physics. The American College of Radiology considers that certification and continuing education in the appropriate subfield(s) demonstrate that an individual is competent to practice one or more of the subfields in medical physics to be a Qualified Medical Physicist. The ACR recommends that the individual be certified in the appropriate subfield(s) by the American Board of Radiology (ABR).

The subfields of medical physics are Therapeutic Radiological Physics, Diagnostic Radiological Physics, Medical Nuclear Physics, and Radiological Physics.

A qualified medical physicist should be in accordance with the ACR Standard for Continuing Medical Education (CME).

C. Technologist

Technologists performing MRI should:

1. Be certified by the American Registry of Radiologic Technologists (ARRT) as a MR Technologist,

OR

2. Be certified by ARRT and/or appropriate state licensure and have six months of supervised clinical MRI scanning experience, *

OR

3. Have an associates degree in an allied health field or a bachelors degree and certification in another clinical imaging field and have six months supervised clinical MRI scanning experience.

***Supervised MRI Clinical Experience:**

- All training should be documented according to institutional policy with clearly defined goals and objectives
- The technologist must be evaluated by the responsible physician to assure competence
- The MRI facility must have the technologist sign a CME Attestation upon completion of this training and mail this to the ACR.

A technologist performing MRI prior to the effective date of the revised ACR Standard for the Performance of Magnetic Resonance Imaging (10/96) who does not meet the above criteria should be evaluated by the responsible physician to assure competence.

Any technologist practicing MRI scanning should be licensed in the jurisdiction in which he/she practices, if state licensure exists.

Continuing education should involve 15 hours of Category A CME in MRI every 3 years. MRI technologists who have passed the ARRT MRI board exam will automatically satisfy the CME requirement. This is only valid for three years starting on the date that they passed the examination. They will be required to maintain 15 hours of CME during every 3 year period thereafter.

II. EQUIPMENT

- MRI equipment specifications and performance shall meet state and federal requirements.

III. PATIENT AND PERSONNEL SAFETY GUIDELINES

- The site shall maintain documented policies for:
  -Administration of contrast and sedation administered in accordance with appropriate ACR Standards and Policies.

  -Appropriately equipped Emergency Cart which is immediately available.

  -Patient and personnel safety information should be maintained on site.

IV. MOBILE UNITS

- If a mobile MRI scanner serves multiple facilities but has the same physicians, technologists, scan protocols and only uses the film processors at each institution only one application needs to be filed with the ACR. Only one set of clinical

and phantom images should be submitted. (This is essentially a "mobile practice"). The ACR would issue a certificate(s) appropriate for each location that the mobile practice serves.

- If a mobile MRI scanner serves multiple facilities and scan protocols vary then each facility must file a separate set of clinical and phantom images.

- If multiple mobile scanners are used at a facility; all magnets must be accredited.

V. LOANER MAGNETS

Accredited facilities may use a "loaner" magnet to temporarily replace an accredited magnet that is out of service for repairs, etc. for up to 30 days without submitting clinical and phantom images for evaluation. However, the accredited facility must immediately notify the ACR of the installation date, manufacturer and model of the loaner. If the loaner is in place for longer than 30 days, the facility must submit the unit for accreditation evaluation, including clinical and phantom image assessment and the corresponding fee.

VI. QUALITY CONTROL

The on-going quality control program assesses relative changes in system performance as determined by the technologist, service engineer, qualified medical physicist, or the supervising physician.

As per the ACR Standard for the Performance of Magnetic Resonance Imaging the following tests are recommended:

1. Measurement of central frequency (at least daily)
2. Measurement of system signal-to-noise ratio on a standard head or body coil (daily)
3. Assessment of image quality and image artifacts (at least daily)
4. Processor sensitometric testing (weekly)

The following quality control tests shall be performed and documented at least semi-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, location and separation

All quality control testing shall be carried out in accordance with written 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.

VII. CLINICAL IMAGES

The site must provide the required clinical images from every magnet at its practice location to be evaluated for ACR MRI Accreditation. This is an accreditation process for general MRI services.

The following sets of images (which must be original 14 x 17 films or refilmed from original tapes or discs) are required for the MRI accreditation program:

Please note the following:

If your site routinely performs localizer or scout sequences with the clinical exams listed below, then include those with your clinical image submission.

Sites cannot submit examinations performed on models or volunteers.

1. Routine Brain examination (for headache)
   -Sagittal short TR/short TE with dark CSF
   -Axial or coronal long TR/short TE (or FLAIR) and long TR/long TE (e.g., long TR double echo)

2. Routine Cervical Spine (for radiculopathy)
   -Sagittal short TR/short TE with dark CSF
   -Sagittal long TR/long TE or T2*W with bright CSF
   -Axial long TR/long TE or T2*W with bright CSF

3. Routine Lumbar Spine (for back pain)
   -Sagittal short TR/short TE with dark CSF
   -Sagittal long TR/long TE or T2*W with bright CSF
   -Axial short TR/short TE with dark CSF and/or long TR/long TE with bright CSF

4. Routine Knee examination (for internal derangement)
   -Sagittal and coronal with at least one sequence with bright fluid

Each set of clinical images will be evaluated for :

1. Pulse sequences and image contrast.
2. Filming technique.
3. Anatomic coverage and imaging planes.
4. Spatial resolution.
5. Artifacts.
6. Exam ID - All patient information annotated on clinical exams will be kept confidential by the ACR.

Please consider the following parameters when performing your examinations. The values shown below are intended to serve as recommendations. The numbers do not constitute a threshold for failure.

Sequence	Slice Thickness	Gap	Maximum Pixel Dimension
Brain - Sagittal & Axial and/or Coronal	≤5 mm	≤2 mm	≤1.2 mm
Cervical Spine - Sagittal	≤3 mm	≤1 mm	≤1 mm
Cervical Spine - Axial	≤3 mm	≤1 mm	≤1 mm
Lumbar Spine - Sagittal	≤5 mm	≤1.5 mm	≤1.5 mm
Lumbar Spine - Axial	≤4 mm	≤1 mm	≤1.5 mm
Knee - Sagittal & Coronal	≤4 mm	≤1 mm	≤.75 mm

MRI Facilities should use the determinants and formulas listed below to determine the spatial resolution of their clinical MRI examinations. They can also be used in conjunction with any deficiencies noted on this final report to help determine which MRI scan parameters may need to be modified.

SPATIAL RESOLUTION

There are five determinants of voxel dimensions in an MRI examination:

a. Slice thickness (ST)
b. Field of view along the phase encode axis (FOVp)
c. Field of view along the frequency encode axis (FOVf)
d. Number of phase encoding steps (Np)
e. Number of frequency encoding steps (Nf)

SPATIAL RESOLUTION EQUATIONS

In plane pixel (phase) = (FOVp/Np)

In plane pixel (read) = (FOVf/Nf)

Pixel area = (FOVp/Np) x (FOVf/Nf)

Alterations in any of these five parameters will result in a modification of the voxel volume, the signal-to-noise ratio (SNR) of the image, and the amount of partial volume averaging exhibited in the image. Alterations in the number of phase encoding steps (Np) affects scan time, while alterations in the number of frequency encoding samples (Nf) may affect the maximum number of slices as well as the minimum possible TE for the imaging sequence.

VIII. QUANTITATIVE PHANTOM TESTING

Clinical image review and phantom review are intended to complement each other for a comprehensive evaluation of the quality of MRI services. The criteria for evaluation are independent of field strength and can be applied uniformly so that all magnets are measured against a single standard.

Each site is required to submit phantom images using the ACR protocol **AND** phantom images using its own routine T1 and T2 weighted scan protocol for head examinations.

The images and testing data will be used to assess:

1. Limiting high contrast spatial resolution
2. Slice thickness accuracy
3. Distance Measurement Accuracy
4. Signal uniformity
5. Image Ghosting Ratio
6. Low Contrast Detectability
7. Slice Positioning Accuracy
8. Image Artifacts

Note:

Consulting Physicists may purchase the MRAP Phantom by contacting J. M. specialty parts at 619-794-7200.
The ACR Phantom test guidance document can purchased from the ACR pub. Sales dept. at 800-227-5463 x3702