

Medical physics aspects in accreditation of radiation oncology practice

Diagnosis of cancer is usually a life-changing experience for patients and their loved ones. As they seek treatment for their disease, cancer patients need to know that they are receiving safe and appropriate care. When the cancer patient receives radiation treatment at an accredited radiation oncology facility, he can rest assured that his treatment will be done at a facility that has met the highest level of quality and radiation safety. Therefore, it is important to understand that every aspect of the accreditation process is overseen by certified, expert radiation oncologists and medical physicists.

Accreditation is important as it signifies achievement in the areas of quality and patient safety as well as recognition by peers in the field of radiation oncology. According to Accreditation Commission for Health Care, Inc., "Accreditation is a process of review that health-care organizations participate in to demonstrate the ability to meet predetermined criteria and standards of accreditation established by a professional accrediting agency. Accreditation of a facility implies that the organization is credible and reputable and is dedicated to ongoing and continuous compliance with the highest standard of quality." To achieve accreditation, a facility's personnel qualifications, equipment requirements, quality assurance (QA), and quality control procedures need to go through a rigorous review process to ensure they have met specific qualifications.

This editorial focuses primarily on the accreditation process implemented by the American College of Radiology (ACR), which is one of the oldest accrediting organizations in the United States of America. In the USA, accreditation is voluntary and involves nongovernmental peer review and implies that the radiation oncology facility has met a defined set of minimum standards. However, accrediting organizations are lobbying the US Congress to adopt a resolution making accreditation mandatory. There are several organizations that offer accreditation for radiation oncology practices. They include ACR, American College of Radiation Oncology (ACRO), and recently American Society for Radiation Oncology (ASTRO). ACR accreditation program was initially launched in 1987. In 2008, ACR started a collaboration with ASTRO to run the program. In 2011, a web-based electronic program was launched by ACR. At present, approximately 670 out of nearly 3000 radiation oncology facilities are accredited by ACR's Radiation Oncology Practice Accreditation program (ROPA) alone. Since its establishment in 1995,

ACRO accreditation program has provided accreditation to approximately 200 facilities. The ACRO accreditation program has also undergone periodic revisions to reflect clinical and scientific advances in the specialty of radiation oncology. ASTRO unveiled its accreditation program for excellence in late 2015. Since the establishment of the first accreditation program, there has been a steady growth in the number of accredited practices. Key benefits of accreditation in the USA have been improvement in the quality of health-care delivery and patient safety as well as strengthening of community confidence.

All organizations offering accreditation in the USA have a secured online web portal to facilitate the application process which is privileged and confidential. The application for accreditation mainly has four requirements: (1) Qualified personnel, (2) systems, (3) quality control, and (4) documentation such as policies and procedures and protocols. If deficiencies are noticed in the application, the facility is informed and requested to submit any missing information before scheduling a site survey by a board certified radiation oncologist and a board certified medical physicist who are actively practicing radiation oncology and are experienced in the equipment and technologies utilized by the facility. The accrediting organizations charge a fee ranging from \$8000 to \$14000 for their services which increase with each additional remote site.

Application for Accreditation

Radiation oncology facility formally submits completed application to the accrediting organization using a secure web-based program. The application includes information about facility staffing, qualifications, equipment, and physical location. Specific questions related to facility's compliance with required practice guidelines and technical standards are answered.

On-site Survey

An on-site survey is scheduled upon completion of the application. The on-site survey starts with an interview with all key personnel that at a minimum should include chief radiation oncologist, chief medical physicist, dosimetrist, chief therapist, administrator, and nurse. During the interview, the information submitted with the facility application is verified and updated. This is followed by a brief tour of the facility.

A preselected number of completed patient treatment records (typical ten) that represent various treatment sites (e.g., prostate, lung, and breast) treated at the facility with treatment techniques such as three-dimensional (3D), intensity-modulated radiation therapy (IMRT), stereotactic radiosurgery (SRS), and brachytherapy (low dose rate [LDR], high dose rate [HDR]) are reviewed and data collected. The medical physicist review of the charts consists of the following items:

- Verification that initial physics independent check for accuracy is performed before delivery of the third fraction
- For treatment involving five or fewer fractions the monitor unit (MU), and treatment plan calculations are checked before the delivery of first treatment
- Documentation of dose delivered to target volume and nontarget tissues in the form of dose volume histogram (DVH) and cross-sectional isodose calculations for IMRT treatments
- Documentation of accuracy of planned dose delivery for IMRT by irradiating a phantom embedded with a calibrated dosimetry system
- Documentation of weekly chart check during treatment course
- Documentation of end-of-treatment (EOT) physics check within 1 week of treatment completion.

Detailed data related to dose prescriptions, immobilization, MU calculations, treatment planning, and QA activities are reviewed and collected in a standardized questionnaire developed by the accrediting organization.

Medical Physics Program Review

Responsibility of designing and implementing a comprehensive physics quality management program (QMP) falls on the facility radiation oncology physicist. During the on-site survey, the physicist surveyor reviews the facility of physics program documentation with the chief medical physicist. The following components of physics QMP are reviewed.

- Documentation of independent verification of each beam output for 3 years
- Documentation of treatment planning system QA program in accordance with the American Association of Physicists in Medicine (AAPM) TG 53^[1]
- Documentation of compliance with TG 51,^[2] TG 106,^[3] TG 120,^[4] and TG 142^[5]
- Documentation of initial and continuing medical education for all staff

The physicist surveyor also reviews documentation for:

- Procedures and records for electrometer and ionization chamber calibration and periodic instrument constancy checks
- Procedures and records for barometer and thermometer calibration and periodic cross-calibration

- Procedures for implementing new treatment techniques
- Physics QMP and reports for linear accelerators, computed tomography (CT) simulators, brachytherapy delivery units, treatment planning systems, and MU calculation software
- Procedures to verify manufacturer's equipment specifications and establish baseline performance values for future comparison
- Treatment plan and MU calculation procedures and protocols
- Initial, weekly, and EOT physics chart check protocols for reviewing accuracy of treatment delivery and corresponding records
- Medical physicist peer-review policy and documentation (TG 103^[6])
- Procedures for periodic checks for integrity of mechanical and electrical patient care devices
- Radiation protection program documentation related to radiation oncology and guidelines for safe practice
- Procedures for measuring output factors for custom electron cutouts
- Procedures for patient dosimetry and physics measurements (diodes, thermoluminescence dosimeter, etc.)
- Service reports for equipment used for patient imaging and treatment
- Procedures for performing patient-specific dosimetry and measurements as requested by the radiation oncologist
- Department and physics policy and procedure manuals.

Practice Guidelines and Technical Standards

Technical standards and practice guidelines have been published by several radiation oncology organizations including ACR,^[7,8] ACRO,^[9] ASTRO,^[10-12] and AAPM.^[1-6,8,13] Guidelines have been adopted for 3D and conformal therapy, IMRT, image-guided radiation therapy (IGRT), HDR, LDR, prostate brachytherapy, stereotactic body radiotherapy (SBRT), SRS, total body irradiation, and communication and informed consent in radiation oncology. Medical physics technical standards on radiation oncology physics for external beam therapy, IGRT, LDR, and HDR brachytherapy are also available. Published AAPM task group recommendations such as TG 40,^[13] TG 51,^[2] TG 53,^[1] TG 103,^[6] TG 106,^[3] TG 120,^[4] and TG 142^[5] are also very helpful in preparing for practice accreditation.

Radiation Oncology Personnel and their Qualifications

Medical director

Every radiation oncology practice must have a medical director who is a radiation oncologist who is responsible for overall department oversight. The medical director should be responsible for instituting and supervising

the continuing quality improvement program as well as oversight of policies, procedures, and personnel.

Radiation oncologist

A physician treating cancer patients should be either certified by a national medical board in radiation oncology specialty or should have satisfactorily completed a radiation oncology residency from a program approved by a national graduate medical education council. The number of radiation oncologists available to a practice should be consistent with patient care, administration, research, and other responsibilities. A radiation oncologist should be available on a daily basis for patient care and quality review. When not physically present, radiation oncologist should be available by other designated means and is responsible for arranging appropriate coverage when unavailable.

Medical physicist

Ideally, a qualified medical physicist should hold an MS degree in physical sciences or bioengineering and be certified in therapeutic medical physics by a national board. A qualified radiation oncology physicist should be licensed if required by the states where such requirements exist. Competency criteria to perform specific clinical physics procedures and duties should be established by the chief radiation oncology physicist. Practices performing a large portion of higher-complexity care may require more medical physicists.

Dosimetrist

Medical dosimetrists should be eligible or certified by a medical dosimetry board. They should also fulfill any state licensing requirements. The radiation oncology physicist should supervise the medical dosimetry functions and related QA activities of the practice.

Radiation therapist and computed tomography simulation therapist

Therapists should fulfill any existing state licensing requirements. Radiation therapists should be eligible or certified in radiation therapy by a national technologist organization. Simulation therapists should be certification eligible or certified in radiation therapy or diagnostic imaging by a national technologists organization. Two radiation therapists must be mandatory for each treatment machine to ensure safe and optimal quality of care. If applicable, cross-competency training in CT, positron emission tomography, and magnetic resonance imaging should be offered.

Patient support staff

These include nurses, nurse practitioners, physician assistant, clinical aides, and medical assistants. Oncology nursing certification for nursing staff is desirable and should be encouraged. Staff providing nursing care should have appropriate training and experience.

Personnel Staffing in Radiation Oncology

It is crucial that radiation oncology facility provides adequate staffing to comply with accrediting organization's practice parameters and technical standards and delivers radiation treatments safely to cancer patients using complex modern technologies. Therefore, accreditation process should include a review of facility's staffing levels for radiation therapists, dosimetrists, medical physicists, and radiation oncologists and for guidance be compared with averages from accredited facilities with similar equipment utilization and staff responsibilities.

Frequent Physicist-related Deficiencies and Recommendations

Listed in this section are recommendations made frequently in the accreditation report. Many of these issues need to be addressed in writing before a facility can be granted accreditation. Serious deficiencies require a detailed documented corrective action plan (CAP). The implementation of the action plan is carefully assessed by the surveyors during reaccreditation process.

- Lack of qualified medical physicist if the physicist is not board certified
- Inadequate physics coverage
- Incomplete treatment prescription. A dose prescription script should include the treatment site (R-brain, L-lung), descriptive treatment technique (anteroposterior-posteroanterior, right lateral/left lateral, seven field IMRT, two arc volumetric modulated arc therapy [VMAT], etc.), beam energy (6MV, 9MeV), modality (x-ray, electron), daily and total dose, daily, weekly and total dose fractionation scheme, and patient-specific dose volume constraints for target and other normal and critical structures
- No documentation of independent check of MU calculations and treatment plan by a physicist
- Weekly physics chart reviews not performed and documented. Physicist should generate a list of quality parameters reviewed weekly and sign and date the form
- EOT physics check not performed or performed after 1 week of treatment completion to affirm fulfillment of initial/revised dose prescription. This review must be documented.
- Physicist peer review not documented
- Lack of performance, review, and documentation of QA for IMRT and VMAT before delivery of the first fraction to ensure accuracy of dose delivery
- Lack of performance of rigorous acceptance testing, commissioning, and periodic QA for treatment planning system using a series of test cases to ensure that the hardware and software were installed properly. No log for hardware/software data changes and recommissioning checks

- Incomplete or no treatment prescription for brachytherapy
- Incomplete treatment plan documentation. Such documentation should include DVHs for target and critical structure, digitally reconstructed radiographs, isodose distributions in three orthogonal planes, dose calculation algorithm, calculation grid size, and whether heterogeneity calculation was performed
- Documentation of patient radiation survey before and after an HDR procedure
- Documentation of presence of radiation oncologist and medical physicist during the entire HDR procedure
- Lack of weekly (every 5th fraction) physics check for brachytherapy and BID treatments
- No written order for simulation and no description of immobilization devices to be used for simulation.

In general, physics related deficiencies 3, 5, 6, 9, 10, and 11 are observed more frequently.

Accreditation Survey Report

A committee selected by the accrediting organization (e.g., ROPA at ACR), composed of practicing board-certified radiation oncologist and medical physicist experts, reviews the information submitted during initial application and verified during the on-site survey and data, and findings gathered on-site by the surveyors. An accreditation report is issued that includes.

- Comparison of facility staffing levels with averages for similar accredited facilities. This helps facilities identify issues related to staff and equipment utilization. The report may include recommendations for staffing levels. Inadequate staffing levels typically do not lead to withholding of accreditation unless it can lead to noncompliance with practice parameters and technical standards and compromise patient safety
- Assessment of radiation oncology practice's compliance with program requirements and technical standards as stated in the application and verified by surveyors
- Comments on individual cases reviewed during on-site survey by both surveyors. All data collected and any deficiencies found in patient records are reported
- Specific recommendations for improvement based on practice guidelines, technical standards, and AAPM reports.

The accrediting organizations typically follow a three (ACR and ACRO) to four (ASTRO) year cycle. Accreditation is granted if the facility is found to comply with required practice guidelines and technical standards. Even when accreditation is granted, there are always recommendations for improvement which do not require written response. If minor deficiencies are observed, the accreditation is deferred, and the facility is asked to submit a CAP that addresses each recommendation in the

report. The facility may also be asked to submit additional documentation. Facility performs a self-audit and submits the results to the accrediting organization for evaluation. If major deficiencies are discovered in the program, accreditation is denied. The facility is asked to submit a CAP for approval by the committee. A follow-up survey is conducted after response to CAP is received.

A radiation oncology facility is ineligible for accreditation if it does not have adequate coverage and access to board certified radiation oncologist and medical physicist. This can pose a challenge in developing countries where a shortage of qualified and properly trained staff exists. Awareness and education of patients in the USA to seek, when possible, accredited cancer care facilities have been feasible by the efforts of organizations such as American Cancer Society, ACR, and American Society of Radiation Oncologists. In developing countries, a concerted effort should be made to initiate the process of accreditation. A mechanism should be developed to establish national accreditation organizations which can grant accreditation to radiation oncology and medical physics practices. Modern linear accelerators, capable of delivering complex treatment techniques such as IMRT, VMAT, SBRT, and SRS are being introduced rapidly in these countries which require properly trained staff and implementation of comprehensive QA processes to ensure accurate delivery of radiation dose and patient and staff safety. In the hands of poorly trained cancer care personnel, such technologies can lead to compromised treatment and patient safety. It is imperative that organizations such as Association of Medical Physicists of India in collaboration with the International Organization of Medical Physics, initiate and play a prominent role in the establishment of national accreditation agencies to improve the quality of health-care services in India.

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