HKCRRT

The Hong Kong College of Radiographers and Radiation Therapists

Standards of Practice for Medical Dosimetry

By

Medical Dosimetry Faculty

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1. Brief information/background of medical dosimetry

The health care professional performing the practice of medical dosimetry is responsible to design a treatment plan using ionizing radiation to treat mainly oncology patients. Medical dosimetrists have the expertise in generating quality radiation treatment plan and also perform dose calculation. They must maintain a high degree of accuracy in treatment planning optimization, treatment techniques and positioning.

As one of the radiation oncology team members, medical dosimetrist must possess the knowledge of the overall characteristics and clinical relevance of radiation oncology treatment planning. They must uphold a commitment to a high degree of accuracy, thoroughness and safety. It is essential for medical dosimetrists to actively communicate with radiation oncologists, medical physicists, radiation therapists who are working in treatment unit and also nurses. Effective communication is not only to ensure the effective transfer of information but also ensure the patient's physical needs and emotional needs are addressed.

Medical dosimetrists must demonstrate good understanding of various topics like human anatomy and physiology, pathology, radiation oncology, cancer patient psychology, radiation physics, radiation biology, radiation treatment technique, radiation safety and protection.

Medical dosimetrists are required to use critical thinking and professional judgement to perform treatment planning. Continuous professional development of medical dosimetrist is essential to enhance their competence.

2. Safety and precautions

2.1 Radiation protection

Apply the principle of as low as reasonably achievable (ALARA) to minimize radiation exposure to patient, self and others.

2.2 Safety specific to specialty

2.2.1 For new radiation treatment plans, checking previous plans to avoid inadvertent retreatment.

2.2.2 Correct steps and checking of image cataloging and manipulation (e.g. image fusion, registration, segmentation.

2.2.3 Verify accuracy and appropriateness of target volumes, including Gross Tumour Volume (GTV), Clinical Target Volume (CTV), Internal Target Volume (ITV),

Planning Target Volume (PTV) and critical normal tissue.

2.2.4 Take part in radiation treatment plans e.g. Intensity-modulated radiation therapy (IMRT), Image-guided radiation therapy (IGRT) quality check to ensure correct dose delivery.

2.2.5 Define dose fractionation techniques. Normal tissue dose-volume parameters are compared to specified constraints.

2.2.6 Verify beam designs, dose calculation parameters and reasonability of dosimetric results. Check evaluation metrics for correctness and compare to plan directive.

2.2.7 Pay attention to the under-dosed target or normal tissue hot-spots.

2.2.8 Peer review is essential. Medical dosimetrists can check each other's work, e.g. assess selection of beam orientation and weighting, evaluate plan for target coverage and normal tissue exposure.

3. Roles & responsibilities of medical dosimetrists

3.1 Data integrity

3.1.1 Understand the radiation treatment planning workflow

3.1.2 Avoid collecting inaccurate data

3.1.3 Verify patient and treatment information before and after planning

3.1.4 Ensure the necessary images and patient information transferred to treatment planning system completely.

3.2 Data privacy

3.2.1 Protect patient privacy

3.2.2 Keep all patient information confidential except when it is necessary to facilitate planning procedures of the patient, or when legally obliged

3.2.3 Patient data is retrieved on an as-needed basis

3.3 Patient identification

3.3.1 Correct patient identification

3.3.2 Use at least 2 different personal identifiers to verify patient's identity (e.g. patient's name, HKID card number, date of birth, phone number or residential address)

3.4 ALARA principle application

3.4.1 The radiation treatment should only be carried out if the benefit of the examination outweighs the risk.

3.4.2 Apply the principle of ALARA to minimize the radiation hazard to patient, staff and others.

3.5 Roles of medical dosimetrists

3.5.1 Traditional Radiation Treatment planning

- Acquire patient data from physical measurement.
- Develop optimal plan with patient's parameters and radiation properties according to oncologist's directive
- Perform dose calculation with consideration of beam modifying devices, irregular fields, gaps for adjacent fields and off-axis of the beams.
- Evaluation of the treatment plan
- Verify treatment parameters/ Machine Unit (MU) manually or with treatment plan verification software.
- Transfer treatment parameters into patient record accurately.
- Assist with the patient set-up and treatment.

3.5.2 Advanced Radiation Treatment Planning

The advanced treatment planning techniques are, but not limited to, 3D conformal Radiation Treatment Planning, IMRT Treatment Planning, 4D Radiation Treatment Planning

- Communicate with treatment staff any challenge they faced at time of simulation.
- Ensure correct orientation of patient image data, from CT or other fused image set, on the planning system.
- Proper selection of treatment devices.
- Image fusion using diagnostic images such as MRI, PET/CT, 4D CT scans and other diagnostic CT images.
- Participate in the analysis of organ motion & delineation.
- Contouring of normal structures.
- Review targets marked by Oncologist
- Design & generate treatment plan under the direction of Oncologist.
- Evaluate plan with Oncologist showing target volume coverage, dose to critical & normal structures with tolerance and dose constraints.
- Transfer plan parameters and plan images to treatment record.
- Verify treatment parameters by transferring data to treatment plan verification software.
- Participate in QA of the treatment plan according to department policies.
- Generate treatment record with treatment plan information required to implement he treatment plan.
- Assist treatment staff during first treatment in setting up the patient and image verification.
- Participate in peer review of patient management including treatment plan, prescription, contouring image verification, etc., with other

members of the Oncology team.

3.5.3 Sealed source Brachytherapy

- Image import & registration
- Implant or applicators localization
- Treatment planning
- Review of the treatment plan
- Any dose calculation if necessary
- Source inventory, preparation and transportation
- Consultation during applicator placement, strength of source and arrangement of the sources in applicators.
- Participate in treatment procedures.
- Order, load and/or remove isotopes.
- Quality assurance of treatment system and associated treatment equipment

3.5.4 Unsealed source Brachytherapy

- Ordering of radioisotopes
- Checking of activities of radioisotopes
- Dose calculation
- Radioisotope inventory, preparation and transportation.
- Assist Oncologist in dose administration.
- Complete the treatment record

4. Requirement of Medical dosimetrists

4.1 Academic qualifications

4.1.1 A qualified medical dosimetrist has the competency to practice in collaboration with radiation oncologist and/or medical physicist. Medical dosimetrist is educated to independently perform duties under the direction of oncologist. Below are the basic requirements that medical dosimetrist required,

4.1.2 Being a radiation therapist registered under Hong Kong Radiographers' Board with valid Annual Practicing Certificate; AND

4.1.3 In procession of Bachelor degree in radiation therapy; AND

4.1.4 In procession of higher academic qualifications in medical dosimetry (e.g. Master degree or above in medical dosimetry) or other medical dosimetrist qualifications recognized by HKCRRT (e.g. pass in Medical Dosimetry Certification Examination of HKCRRT, Certified Medical Dosimetrist issued by MDCB)

4.1.5 With a minimum of 2 years of post-registration working experience in medical dosimetry.

4.2 Manner to handle patients

4.2.1 Medical dosimetrists should communicate with patient clearly and in good manner.

4.2.2 They should always assess patient's need, provide reassurance and privacy.

4.2.3 Medical dosimetrists should also explain and instruct patients at a level that they can understand.

4.2.4 Medical dosimetrists need to address patient concerns regarding the procedure, including the delivery of radiation, keeping the field markings and

4.3 Collaboration

It is essential to collaborate with different parties, including oncologists, medical physicists and other health care professionals, in the process of patient data acquisition, radiation treatment planning, treatment plan evaluation, accurate treatment delivery and quality management for our patients.

4.4 Training and education

4.4.1 The medical dosimetrists should continually strive to improve their knowledge and skill sets related to the profession. The field of radiation oncology is a continuously growing and rapidly evolving field.

4.4.2 It is important for medical dosimetrists to maintain a level of expertise through continuing education and training to keep up with the advancements in the field of radiation therapy. They shall complete 15 CPD points relevant to medical dosimetry in each triennium in order to maintain the certified specialist credential.

4.5 Research and development

Medical dosimetrists are encouraged to participate in research and development to cope with the rapidly evolving of radiation technique and medical dosimetry.

5. Clinical Application

5.1 Traditional Radiation Treatment planning

Two-dimensional planning is generated from a 2D single plane radiographic image or single external patient contour.

5.2 Advanced Radiation Treatment Planning.

Advanced or modern treatment planning requires the availability of 3D and 4D anatomic information and with a treatment planning system that can execute calculation so as to provide 3D and 4D dose-volume statistics for contoured structures. The advanced treatment planning techniques are, but not limited to,

5.2.1 3D conformal Radiation Treatment Planning

Planning CT is done with patient in reproducible position. Treatment site and surrounding organs can be visualized during planning three dimensionally. The final aim is to achieve a plan with optimal field arrangement to deliver conformal radiation dose to the tumour and minimum dose to surrounding normal tissue.

5.2.2 Intensity-modulated radiation therapy (IMRT) Treatment Planning

This is an inverse radiation treatment planning technique with dose across the treatment site is modulated to achieve sharp dose gradients between target and non-target areas. By using multiple radiation beams that containing multiple segments to modify the beam intensity across the field, conformed target dose is achieved with minimal dose to nearby normal tissue. Medical dosimetrist specifies dose constraint for targets, critical structures with beam energy and orientation, the planning system will optimize a plan based on data input to deliver a dose distribution to meet planning objectives.

5.2.3 4D Radiation Treatment Planning

4D Radiation treatment can be defined as the explicit inclusion of the temporal changes in anatomy, planning and delivery of radiotherapy. 4D radiation treatment planning should be employed when respiratory motion is a concern, especially treatment of the thoracic and abdominal region. It involves respiratory correlated CT (4DCT) imaging and image guided tracking of tumour motion. It may be used in IMRT and stereotactic Body Radiotherapy / Stereotactic Ablative Radiotherapy (SBRT/SABR) with the aim of maximizing tumour dose by tracking and compensating for target motion during radiation treatment while reducing dose to surrounding normal tissues. It requires helical multi-slice CT scanners, treatment planning systems.

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5.3 Sealed and unsealed source Brachytherapy

5.3.1 Sealed source Brachytherapy is to use radioactive source to deliver radiation at a short distance by interstitial, intra-cavitary or surface application. This treatment can deliver high radiation dose locally to the tumour with rapid fall off in the surrounding normal tissues.

5.3.2 For unsealed source Brachytherapy, radioactive isotopes are usually administered in liquid form orally, by intravenous infusion or by direct injection into tumours or body cavities.

6. Declaration

The content of this SOP serves as a reference for Radiographers and Radiation Therapists, or the related professionals. It should not be he comprehensive information of the related examination or procedure. The further elaboration of this document is subject to the decision of the council of the Hong Kong College of Radiographers and Radiation Therapists.

7. References

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