Prescribing, Recording, and Reporting Electron Beam Therapy
ICRU Report 71

Executive Summary

The Report extends to electron beam therapy the concepts and recommendations contained in ICRU Reports 50 and 62 for photons. As a general rule, the concepts and recommendations for reporting electron beam therapy should be similar to and consistent with those published for photons. However, the dose distributions with electron and photon beams are quite different and may require different approaches as far as beam arrangement, treatment planning and also clinical indications are concerned.

The report deals mainly with harmonisation in reporting. However, without interfering with the prescription, or with the local policy for recording the treatment parameters, all procedures would be simplified and faster and the risk of confusion and accidents would be reduced if the same definitions of terms and concepts and the same methods for specifying doses and volumes were used for prescribing, recording and reporting the treatments.

As a general requirement, and as recommended in the other ICRU Reports, the irradiation conditions should be completely reported as well as the time-dose patterns. No weighting factor for RBE difference (relative to photons) has to be applied for the currently used electron energy range.

Volume concepts

Reflecting the similarities between electron and photon treatments, Chapter 2 on Volumes in the present report is very similar to the Chapter on Volumes in Reports 50 and 62.

The concepts of Gross Tumour Volume (GTV), Clinical Target Volume (CTV), Planning
Target Volume (PTV), Treated Volume, Organ At Risk (OAR) and Planning Organ at Risk Volume (PRV), as defined for photons in the previous reports, are recalled. Evolutionary clarifications applicable to both modalities are given and new examples are provided to illustrate these concepts.

**Physical and dosimetric data**

Background information on the characteristics of the clinical electron beams, and physical and dosimetric data necessary for the understanding and correct interpretation of the recommendations are provided in Chapter 3.

**ICRU Reference Point for reporting electron beam therapy**

The general principles for reporting electron beam therapy (Chapter 4) are in agreement with the recommendations for reporting photon beam therapy (Reports 50 and 62). They are based on the selection of a reference point for reporting, which is referred to as the ICRU Reference Point. This point should always be selected at the centre (or in the central part) of the PTV and should be clearly indicated.

In general, in electron therapy, the beam energy and the beam delivery system are adjusted so that the maximum of the depth-dose curve on the beam axis (“peak dose”) is reached at the centre (or in the central part) of the PTV. The peak dose is always available and directly related to the number of monitor units in reference conditions, i.e., beam incident perpendicularly to a homogeneous medium. This point should be selected as the ICRU Reference Point for reporting.

If the peak dose is not obtained in the central part of the PTV, the ICRU Reference Point for reporting should be selected at the centre of the PTV but, in addition, the peak dose should also be reported.
Following dose values should be reported for reference irradiation conditions:

- the peak absorbed dose to water;
- location of and dose value at the ICRU Reference Point if not located at the level of the peak-absorbed dose;
- the maximum and minimum dose in the PTV, and dose(s) to OAR(s) derived from dose distributions and/or dose-volume histograms.

**Reporting dose in non-reference conditions**

Specific recommendations for reporting are provided for non-reference conditions: small and irregularly shaped beams, oblique beam incidence and presence of heterogeneities.

When corrections for oblique incidence and heterogeneity are applied they should be reported (Chapter 5). The peak absorbed dose to water for reference conditions should also be reported.

**Intra-Operative Radiation Therapy (IORT)**

Chapter 6 deals with special techniques where electrons are applied: Intra-Operative Radiation Therapy (IORT) and Total Skin Irradiation (TSI).

In IORT, electrons are used to deliver a large dose in a single fraction after surgical exposure of a well-defined anatomical area. The CTV is defined as accurately as possible jointly by the surgeon and the radiation oncologist during the procedure.

The irradiation procedures specific to IORT must be reported: electron energy, IORT applicator system (type, shape, bevel angle, size of the applicator, flattening filter, etc.). The ICRU Reference Point for Reporting is always selected in the centre (or central part) of PTV and,
when possible, at the level of the maximum dose on the beam axis.

Following dose values should be reported:

- peak absorbed dose to water, in reference conditions, for each individual beam (if the beam axis is perpendicular to the tissue surface);
- for oblique beam axis, the maximum absorbed dose in water on the “clinical axis” (i.e., the axis perpendicular to the surface of the tissues, at the point of intersection of the central axis of the beam with the tissue surface);
- location of, and dose value at the ICRU reference point (if different from above);
- best estimate of the maximum and minimum dose to the PTV. Usually the irradiation conditions (electron energy, field size, etc.) are selected so that at least 90 percent of the dose at the ICRU Reference Point is expected to be delivered to the entire PTV.

**Total skin irradiation (TSI)**

TSI is indicated to treat selected cutaneous T-cell lymphomas (*Mycosis fungoides*). The aim is to irradiate the total skin envelope as homogeneously as possible. For patients with superficial disease, TSI can be delivered with one electron energy. In other clinical situations, the thickness of the skin disease may vary with stage, pathology and location on the body surface. Several CTVs need to be identified and different beam penetration have to be used.

TSI implies identification of several anatomical areas. For each anatomical area, an ICRU Reference Point for reporting has to be selected always at or near the center of the PTVs/CTVs. The Reference point may be at the level of the peak dose if it is located in the central part of the PTV.

In addition an ICRU Reference Point, clinically relevant and located within the PTV, can be selected for the whole PTV.
Following dose values should be reported:

- peak absorbed dose in water for each individual electron beam;
- location of, and dose value at the ICRU Reference Point for each anatomical area (the ICRU Reference point may or may not be at the level of the peak dose);
- best estimate of maximum and minimum dose to each anatomical area;
- location and absorbed dose at the ICRU point for the whole PTV, and best estimate of the maximum and minimum dose for the whole PTV;
- any other dose value considered as clinically significant.

Quality assurance

Chapter 7 is devoted to quality assurance for imaging, acquisition of patient data, quality control of the accelerator, acquisition of beam data, treatment planning system, patient set-up and in-vivo dosimetry.

Clinical examples

A summary is presented at the end of the Report (Chapter 8) recalling the quantities, reference points and volumes recommended for reporting electron beam therapy.

As an Appendix to the Report, clinical examples from several Radiation Oncology Centres are presented and fully discussed to illustrate how to interpret the concepts and apply the recommendations developed in the Report for reporting electron beam therapy. They should not be interpreted as ICRU recommendations for selecting a given technique, beam arrangement or dose level.

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