Patient-Specific Quality Assurance

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56.1 Introduction

The importance of QA in RT cannot be overstated: indeed, in most modern departments, quality and safety activities accompany the patient along their journey from referral to treatment. The aim of such activities is two-fold: minimise the risk of accidents and provide optimal quality of treatment (see section on quality assurance programmes in radiation oncology).

Patient-specific QA activities are part of a larger departmental risk management strategy which must cover both structural/systematic and human errors and their interplay [1]. Patient-specific QA addresses elements along the treatment path (Fig. 56.1) that are heavily dependent on specific features of the tumour, such as: delineation of targets and organs, beam arrangement, dose prescription and dose limitation to organs at risk. Patient-specific QA intervenes across the treatment chain and has a twofold aim: avoid continued reproduction of human and systematic errors to a patient's treatment and, with equal importance, ensure optimal quality of treatment, that is, maximise the therapeutic ratio. From a risk management perspective, patient-specific QA represents the last set of barriers to mitigate mistakes. It also represents an important quality improvement tool. This chapter focusses on key elements of patient-specific QA, in particular peer review, delivery QA and IGRT protocols.

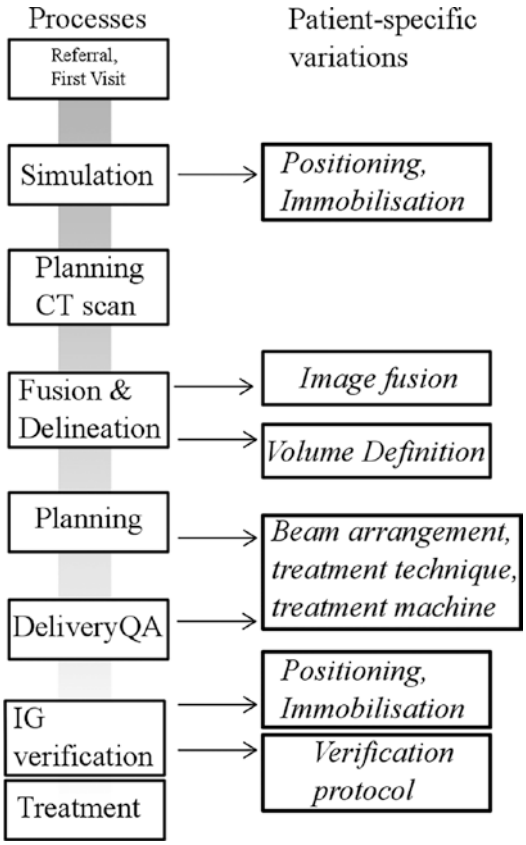

Fig. 56.1 Sources of patient-to-patient variations and errors across the treatment chain. *IG*, Image guided

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Table 56.1 Example of a template protocol for peer review

Patient class-specific checklist—template	Acceptable	Acceptable variation	Unacceptable variation
Image co-registration (if applicable)			
Target delineation (margins, extension, anatomical barriers. Separate boost entry if required)			
Target coverage (prescription, uniformity, acceptable compromises. Separate boost entry if required)			
OAR delineation (extension, PRV margins)			
OAR dose constraints (provide priority and thresholds for all prescription doses, if multiple)			
Overall outcome			
Date and signatures			

Bold: radiation oncologist, *Italic*: medical physicist. Details from the actual clinical protocol for the selected patient class should be reported, including guidance on delineation borders, margins, and dose-volume thresholds.

56.2 Methods for Patient-Specific QA

Peer review is a process defined as a reassessment of the treatment plan by a multidisciplinary team of one or more radiation oncologists, medical physicists and dosimetrists/RTTs. According to an analysis of literature on peer review, 10% of peer-reviewed plans are modified and 2.5% undergo major modifications, averaged over mixed diseases sites. This study suggests that peer review is a valuable tool, albeit such rates may differ across different disease sites [2]. Furthermore, it has been observed that plans not conforming to established clinical protocols result in worse outcome for patients [3].

If departmental resources do not allow for peer review of all plans, the frequency of peer review should include a proper selection based on the disease prevalence, anatomical location, dose fractionation schedule and chosen treatment technique.

Peer review is primarily a tool to reduce inter-observer variability in the clinic: as such, the re-evaluation of the patient plan should not only be a "second opinion" but also a systematic evaluation based on a predefined protocol. Such protocols should ensure scoring of plans against the departmental protocol for the specific class of patients considered. For example, peer review of locoregional treatment of breast cancer patients should include an evaluation on target volume and organ at risk delineation and coverage; recognising that left vs right breast irradiation scoring might differ concerning dose constraints (e.g. for the heart). The peer-review protocol should list which elements of the plan should be evaluated, by which staff members, and against which criteria. We report an example in Table 56.1.

Measurement of delivery of the plan on a phantom, or delivery QA, can be considered part of the peer-review process. Delivery QA can be performed by a variety of techniques, a detailed breakdown of which is beyond the scope of this chapter. It is, however, important to sample the output dose distribution, preferably on several points, and compare with the planned distribution, for example by means of gamma analysis. Pure recalculation of dose distribution checks only the quality of the beam model so it must be coupled with absolute output measurements to offer a complete end-to-end delivery QA.

56.3 Recording Peer-Review Outcome

Recording peer-review outcome is as important as conducting peer review. Wet-ink signed paper records or digitally signed Electronic Health Records can be used. All peer-review parameters should be recorded in an electronic database or

spreadsheet, preferably entered directly by the reviewers. If paper records are used, double data entry in an electronic spreadsheet is recommended, that is, data should be entered by two different personnel independently with a simple automated identity check to minimise the risk of input mistakes.

It is highly recommended to establish a proper taxonomy of peer-review outcomes for the records, and to use standard terminology for structures and dose-volume parameters. This standardisation effort greatly facilitates retrospective studies and inter-departmental data sharing. It is recommended to classify peer-review outcomes using the terminology suggested by the Global Harmonization Group as *Per Protocol* (green light), *Acceptable Variation* (yellow light), *Unacceptable Variation* (red light, replan) [4], to use AAPM TG 263 for structure naming and dose-volume parameters [5] and the Global Harmonization Group OAR consensus contouring guidance for delineation of organs at risk [4].

More importantly, recording peer-review feedback allows for observation of intra- and inter-departmental historical trends, a crucial tool for quality management. Plan elements which frequently perform poorly in peer review can prompt corrective actions to be taken, and intra-reviewer biases addressed to improve consistency of the peer-review process across the department. Frequent reports should be produced on the aggregated peer-review records by the departmental quality manager and discussed with the multidisciplinary team.

56.4 IGRT Methods

In room IGRT is an essential step for high-quality RT treatment delivery for breast cancer patients. It not only provides verification of target volume dose delivery which has been shown to increase overall survival [6, 7] but also allows for the adaption/individualisation of margins to reduce normal tissue toxicity. IGRT employs either 2D or 3D imaging and/or surface guidance. The type of image guidance used is dependent on locally available equipment, whereas the frequency and timing (online versus offline) is driven by the chosen treatment technique, dose/fractionation schedule, local practice of adaptive RT, target and normal tissue motion versus the possible detrimental effect of its dose to the patient [8]. Because of these variabilities strict guidance is left to national guidelines or, where these do not exist, up to the department itself.

56.5 Summary

Patient-specific QA is necessary to ensure high-quality standards of treatment and should be conducted according to pre-specified protocols. Its benefits not only affect the individual patient, but if organised correctly, the entire patient population. Outcomes should be recorded as part of a department's long-term quality improvement strategy.

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