FALL 2020

NSIR-RT BULLETIN

Welcome to the electronic bulletin for the National System for Incident Reporting - Radiation Treatment (NSIR-RT). This Bulletin supports continuous learning from incident data through the presentation of data trends and case studies. It will also provide system users with information on program developments and enhancements

CASE STUDY: THE "IMPACT" OF DOSIMETRIC IMPACT

The International Commission on Radiation Units & Measurements (ICRU) Prescribing, Recording, and Reporting Photon Beam Therapy (Report 50) describes key volumes for consideration in radiation therapy planning. The gross tumour volume (GTV), and the clinical target volume (CTV), are defined through clinical investigation. The planning target volume (PTV) provides a margin to account for intra and inter fractional setup uncertainties [1]. These conventions provide practitioners with a common language to describe radiation treatment planning concepts.

Accounting for intra and inter fractional setup uncertainties, the PTV provides a margin for "error." However, this margin (site and technique specific) only accounts for clinically insignificant deviations. A geographic miss describes significant deviations beyond the PTV, causing treatment failure due to an underdose to a portion of the PTV [2]. This generalization does not completely describe the spectrum of potential setup errors.

NSIR-RT BY THE NUMBERS

Incidents Submitted: 4,807
Actual Incidents: 3,047
Near Miss: 1,402
Programmatic Hazard: 358

Severity
None: 2,308
Mild: 677
Moderate: 55
Severe: 7

In 2009, Everitt et al. proposed a framework to characterize three potential geographic miss scenarios [3] described in Figure 1.

Scenario 1 describes an instance where a portion of the treated PTV is located outside the planned PTV (but the GTV is within the planned PTV). Scenario 2 describes an instance where a portion of the treated GTV is located outside the planned GTV and PTV. Scenario 3 describes and instance where the treated GTV is completely located outside the planned GTV.

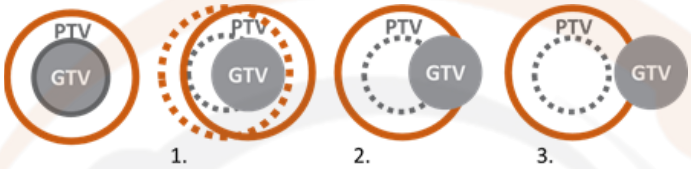

Figure 1

In addition to describing the type of dosimetric variation, characterizing the magnitude of the deviation relative to the total prescribed dose provides practitioners with a deeper understanding of a radiation under or overdose. In the United Kingdom, there exists several guidelines for describing and reporting calculated dose deviations [4].

So why is this important? Leveraging taxonomies as well as conventions for calculating and reporting dosimetric impact can provide clinicians with a better manner to manage, correct for, and classify the dosimetric impact of an incident and ultimately, its impact on patient outcomes.

EDUCATIONAL OPPORTUNITY

The Institute for Safe Medication Practices (ISMP) Canada is offering continuous learning opportunities via live virtual workshops. *Incident analysis and proactive risk assessment* is a 1.5-day workshop providing healthcare practitioners with background theory and hands-on practice in incident analysis (root cause analysis, RCA) and proactive risk assessment using failure mode and effects analysis (FMEA). Please visit the ISMP Canada website for upcoming dates.

A review of incidents submitted to NSIR-RT show a total of 630 incidents where there was at least some patient harm noted (Figure 2).

The following example, submitted to NSIR-RT describes an incident in which aforementioned Scenario 3 has occurred and provides one program's approach to assessing the dosimetric impact, implications, analysis and lessons learned.

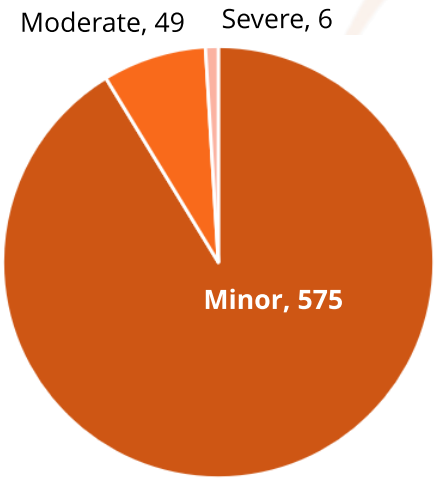

Figure 2: NSIR-RT incidents with noted dosimetric impact

Geographic miss following imaging guidance

Overview/Incident Description

A patient was planned for stereotactic ablative radiation therapy (SABR) to a lung lesion, with a total of 4 planned fractions. On fraction #4, as per clinic on-treatment imaging and delivery protocol, the patient was first imaged using stereoscopic x-ray imaging, with bony anatomy match to spine, and corresponding shifts were applied. A cone beam CT (CBCT) with automatch to PTV was acquired following shifts from stereoscopic imaging.

Based on CBCT, a 4 mm longitudinal shift was required, applied, and a repeat CBCT was taken to confirm the final treatment position as per clinic policy. Images were reviewed by two Radiation Therapists (RTT) prior to initiating treatment.

Following treatment, images were sent for review by the primary Radiation Oncologist (RO), as per clinic policy due to the 4 mm shift from CBCT images (policy is to send images to attending RO if CBCT shift ≥ 3mm is required).

On image review, the RO discovered a bony alignment mismatch of 1 vertebral body that resulted in a complete geographical miss of the targeted lung lesion.

Investigation

Following incident discovery, the Medical Physicist completed a chart check by fusing the SABR plan to the actual treated volume for one fraction to determine the dosimetric impact. A review of fractions 1-3 was also completed, to verify no additional misalignments had occurred for this patient.

A full geographical miss of the target volume, along with full dose given to un-intended normal tissue/organs was determined for one fraction (fraction #4), and as a result the dosimetric impact was classified as "severe" using the NSIR-RT nomenclature.

The incident was reviewed by a multidisciplinary group who determined that the automated matching on stereoscopic imaging had "skipped" a vertebral body within the region of interest selected. The stereoscopic automatch determined a shift of 22.3 mm and was applied by the RTTs prior to proceeding to CBCT verification. Automatic soft tissue matching of the CBCT imaging resulted in a 4 mm maximum shift.

The RTTs examined the anatomy in the immediate vicinity of the automatch, and believed the match to be acceptable, attributing any changes to the appearance of the target volume a result of the patient being at the end of their treatment course.

Top 5 Problem Types associated with dosimetric impact	
247	Wrong patient position, set up point or shift
135	Wrong, missing, mislabelled or damaged treatment accessories
35	Wrong prescription dose fractionation or calculation error
33	Failure to perform on treatment imaging per shift
19	Wrong target or OAR contours

After speaking with the RTTs, it was discovered that there appeared to be an unreported increase in the frequency where automatic stereoscopic matching was "skipping" a vertebral body in this context. A review of all SABR lung cases treated to date was completed. No further geographical misses were identified.

Risk Mitigation

In an effort to reduce the likelihood of recurring issues of a similar type, the radiation treatment program changed the matching policy and action levels, offered education to staff and notified the vendor of the increased frequency of these events being seen.

CPQR AND YOUR INCIDENTS: LEARNING FROM THE STORIES YOU SHARE

The Canadian Partnership for Quality Radiotherapy (CPQR) is committed to advancing radiation treatment safety. The work they do exemplifies their dedication to that goal; namely, analyzing radiation treatment incidents, making and disseminating recommendations for the prevention of radiation treatment incidents, and facilitating quality improvement initiatives.

The CPQR is a key partner in NSIR. Some members of the CPQR form the NSIR-RT Advisory Committee and are also users of the system with access to anonymous NSIR-RT data. Incident submissions are monitored to identify those that could provide valuable learning directed toward improving patient safety. To learn more about certain incidents, CPQR may contact submitting organizations through NSIR-RT Advisory Committee members. Read below to learn about this process.

Why has the CPQR contacted my organization?

CPQR routinely scans NSIR-RT data. If the CPQR believes valuable lessons can be learned from an incident to improve patient safety, and that highlight particular safety issues, they may contact the submitting organization to learn more.

How did the CPQR know my organization submitted an incident?

CPQR has representatives on the NSIR-RT Advisory Committee that are users of the system. They cannot identify where the data comes from as the data does not have any facility, patient or provider identifiers. Through the NSIR communication tool, they can send a message to the submitter of an incident without knowing which organization submitted it. When a message is added to an organization's inbox in the NSIR communication tool, automated emails are generated to all the organization's registered NSIR users notifying them that there is a message in the NSIR communication tool.

What do I do when I receive their request?

We encourage you to respond. You can remain anonymous by using the NSIR communication tool, or you can call or email the contact person named in the note from the CPQR.

MORE ON PANDEMIC-RELATED ERRORS

COVID-19 has complexified cancer treatment through unprecedented deviations from routine practice for the sake of patient and staff safety. The case study in our **Summer 2020 NSIR-RT Bulletin** focused on radiation treatment incident reporting in a time of pandemic. We highlighted current challenges associated with these changes and emphasized the importance of continuing to submit incidents. The Radiation Oncology Incident Learning System (RO-ILS) developed by American Society for Radiation Oncology (ASTRO) and American Association of Physicists in Medicine (AAPM), recently published ***COVID-19 Disruptions of Processes***, a theme report showcasing three case examples summarizing how the pandemic can create or contribute to an error pathway. The report includes strategies to mitigate extended disturbances to standard of care and may prove useful to local practice in Canada.

Case Study References:

1. D. Jones (Reviewer), "ICRU report 50—prescribing, recording and reporting photon beam therapy," Med. Phys. 21 (6), 833 (1994).

2. Parikh, S., Suhrid Parikh Department of Radiation Oncology, Nori, D., Dattatreyudu Nori Department of Radiation Oncology, Tripuraneni, P., & Prabhakar Tripuraneni Division of Radiation Oncology. (2001, March 27). Geographic Miss: A Cause of Treatment Failure in Radio-Oncology Applied to Intracoronary Radiation Therapy. Retrieved from https://www.ahajournals.org/doi/10.1161/01.CIR.103.12.e65

3. Everitt, S., Kron, T., Leong, T., Schneider-Kolsky, M., & Manus, M. M. (2009). Geographic miss in radiation oncology: Have we missed the boat? Journal of Medical Imaging and Radiation Oncology, 53(5), 506-509. doi:10.1111/j.1754-9485.2009.02102.x

4. Eaton, D. J., Byrne, J. P., Cosgrove, V. P., & Thomas, S. J. (2018, April). Unintended doses in radiotherapy-over, under and outside? Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/29293373