

NSIR-RT BULLETIN

Welcome to the electronic bulletin of 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.

NSIR-RT Relevance to a Recent RO-ILS Case Study on Contour Delineation

NSIR-RT data continues to be a useful tool for Canadian cancer centres to reflect and learn from near misses and actual events. Sourced from the application used by Canadian health care facilities, data are shared securely and anonymously to allow cancer centres to analyze and discuss radiation treatment incidents.

In a recent ASTRO/AAPM sponsored Radiation Oncology Incident Learning System (RO-ILS) case study, on clinical process of contour delineation, the contours were wrongfully delineated and caught as a near miss through their QA processes. To date, of the 2,529 near miss incidents submitted to the NSIR-RT database, less than 1% were related to contour delineation.

For those interested in better understanding the safety barriers and processes in place that have caught this type of error at your centre, or those who would like to understand potential trends across the province or country, look through your local data or try a CIHI data request to compare your local centre to others. Relevant data fields include:

Hardware/Software:

- Image-based target or OAR verification

Process:

- Verification of imaging data for planning
- Oncologist peer review
- Oncologist review of treatment plan
- Radiation therapist review of treatment plan
- Physicist review of treatment plan



The Self-Audit Tools CPQR developed for programs to evaluate compliance with CPQR guidelines and guidance documents offer another opportunity for reflection on quality and improvement. Since 2020, twelve centre self-audits were completed against the Quality Assurance Guidelines for Canadian Radiation Treatment Programs.

The majority noted a need to continue improvement for:

- Key Quality Indicators #34 (Percentage of adjuvant or curative radiotherapy treatment plans that undergo Radiation Oncologist peer review prior to the start of treatment)
- #35 (Percentage of adjuvant or curative radiotherapy treatment plans that undergo Radiation Oncologist peer review before 25% of the prescribed dose has been administered)
- #36 (The radiation treatment program has a process for peer review of palliative radiotherapy plans)

Stories from Users

Update of Pre-Treatment Quality Control Procedure

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Abstract

The medical physicist team at the Centre intégré universitaire de santé et services sociaux de la Mauricie-et-du-Centre-du-Québec (CIUSSS MCQ) in Trois-Rivières reviewed a 20-year-old pre-treatment quality control procedure that is completed by radiation oncology technologists. The quality control goal was to check the multileaf collimator parameters for treatment fields using a “step and shoot” technique. With input from a review of local incidents and incidents reported to NSIR-RT, together with manufacturer recommendations for treatment equipment, the team developed a new quality control procedure that accounts for current technical and technological realities and can be applied to all types of teletherapy treatment.

Introduction

In November 2021, the radiation oncology technologists at the CIUSSS MCQ in Trois-Rivières asked the medical physicists to review a pre-treatment quality control procedure for linear accelerators and reevaluate its relevance. This 20-year-old pre-treatment quality control procedure was performed by technologists prior to irradiation of the first beam of each treatment field using dynamic step-and-shoot modulation by the multileaf collimator (MLC). The value of the monitor units (MU) at the first movement of the MLC was compared to a value manually recorded in the patient's chart. This comparison could lead to adverse events when recorded MU value had a transcription error.

Background

The quality control under review was established in the early 2000s when use of dynamic modulation with MLC was implemented at CIUSSS MCQ. At that time, the linear accelerators and the treatment planning system (TPS) were different from those in use today. To create fields containing dynamic MLC in a step-and-shoot fashion, files containing leaf position values were exported and modified outside of the treatment planning system before being re-imported into the TPS.

The manual transcription brought with it an elevated risk of error with a potential for significant adverse effects. Multiple quality controls were necessary to ensure treatment safety. Dosimetrists, physicists and technologists needed to check that files containing MLC information were correctly imported and that they matched the treatment plan. The last verification was done by technologists in the control room, immediately before administering treatment. The technologists were required to complete the control procedure for all treatment fields with a dynamic MLC and for each fraction.

Today, the quality control of the MU in fields with dynamic MLC is still in use, but its frequency of execution was reduced to the first fraction of treatment. The main explanation for that change is that the technology used as well as work methods have evolved. The current TPS no longer requires manual modifications of the MLC information outside of the system. The exports and imports of files are no longer completed and the risk of error during file transfers has disappeared. Furthermore, with the increased use of “sliding window” modulation techniques and the advent of arc therapy treatments, this control is performed less often.

Stories from Users

Local Incidents

A search in the local incident and accident declaration tools allowed us to identify and trace three events that took place that were linked to a dynamic MLC.

- September 2007: the wrong MLC information file was attached to the treatment plan. It was not possible to know if the treatment was completed with the wrong file or how the error was detected. The record did not provide enough details about the event.
- June 2008: a patient was treated with six beams without the presence of the scheduled dynamic MLC in one of the treatment fields. The error could have been detected during the MU quality control of the first sub-field, but it was not for these six fractions.
- August 2013: the MU of a sub-field for a patient plan did not correspond to the MU entered on file. In this case, it was a transcription error of the number of MU in the files and not an error related to the plan.

NSIR-RT Incidents

A search in the NSIR-RT database was conducted for all events related to an external radiation therapy treatment in photon therapy, and a search with key word "MLC" in the comments section of registered events. Two relevant events in 2019 were identified and both were classed as non-severe.

- MLC was missing in two treatment fields during a pre-treatment quality control. The error was detected before the treatment was completed.
- One patient was moved to a treatment room for maintenance. The treatment plan was changed, and a secondary dose calculation was performed for the new plan. At the first treatment, when checking the plan parameters prior to treatment the technologists noticed that one treatment field did not contain the expected MLC. The plan was redone to correct the error and treatment resumed.

Notice from the Manufacturer

The manufacturer of the linear accelerators used in Trois-Rivières issued a safety advisory in 2019 where certain machines models may deliver an arc therapy treatment without the leaves moving even if the treatment plan required that the MLC should move. This situation could arise for the treatment machine models used in Trois-Rivières.



Analysis

Research has shown that there are situations where treatment planning and treatment errors related to MLC behaviour do occur. These errors can have significant repercussions on the quality and safety of treatments and can occur for any type of treatment.

Since the introduction of this quality control, technology and treatment techniques have evolved. The human errors expected in the early 2000s no longer occur today because information on the MLC is sent from the treatment planning system to the treatment equipment at the same time as the other information on the treatment plan and this transfer is also automated.

As a result of this analysis, it was found that the initial quality control was no longer appropriate for the equipment and types of treatments used today in Trois-Rivières. It only focused on the verification of step-and-shoot fields and did not apply to fields with sliding window/dynamic MLC or to arc treatments. In addition, the information on the value of the MU at the first movement of the MLCs was no longer necessary because there is no risk of the wrong MLC file being used with the current technology.

Stories from Users

New Quality Control

The medical physicist team suggested to replace the MU value check at the first movement of the MLCs in the dynamic fields with the following control:

- In the patient chart, information on the type of MLC used (no MLC, static, dynamic or arc therapy treatment MLC) must be clearly identified.
- During the first treatment, the technologist must check on the screen that the MLC behaviour matches the expected behaviour for each treatment field.

This quality control procedure is simpler than the original and applies to all teletherapy treatments. The clinical implementation was done in collaboration with treatment and dosimetry technologists. The new quality control measure has been favourably received by the whole team.

Conclusion

The updating of a quality control procedure was done by taking into consideration the historical reasons for a specific control, together with the current risks to the quality and safety of treatments. The documentation of local and national incidents was critical to the analysis of possible risks. Consulting these databases should be part of our verifications when reviewing any procedure.

Continuing Education

CPQR's *Radiation Treatment Incident Investigation Independent Learning Course* continues to be available on the CPQR website **free of charge**. The independent learning program will teach participants how to effectively investigate local incidents using the Canadian Patient Safety Institute (CPSI) guidelines, identify trends through local and pan-Canadian incident analysis and inform programmatic change with the aim of improving overall patient care and outcomes.

Watch the course introduction for more information [here](#).

NSIR-RT BY THE NUMBERS

Incidents Submitted	6,225
Actual Incidents	4,048

Overall Severity

None	3,090
Mild	883
Moderate	67
Severe	8

ABOUT CAPCA

The Canadian Association of Provincial Cancer Agencies (CAPCA) works to improve cancer control across Canada. CAPCA envisions Canadian cancer control systems that are collaborative, patient-centered, and high performing by international standards.