Analysis of Repeat Image Rates and Reasons from The Ottawa Hospital's Radiation Therapy Imaging Modalities

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Introduction

Repeat image analysis (RIA) analyzes the rate of repeated images and reasons for repeat. It is an essential quality assessment tool in diagnostic imaging. However, there is a lack of published literature on its applicability in radiation therapy. Repeats due to daily imaging contribute to excess patient dose and require additional time and resources.

Daily image guidance in radiation therapy has become commonplace with the increased use of intensity modulated treatments, so the involvement of imaging has developed a more prominent role. Repeat image rates and reasons can be used to improve system efficiencies and decrease patient dose.

Objectives

To determine the repeat rate (RR) and the reasons for repeated images on the 9 conventional Linear Accelerators and 3 Computed Tomography Simulation (CT) units at The Ottawa Hospital's radiation therapy department for a 5-month period.

To demonstrate the applicability of RIA in radiation therapy and provide a baseline RR for the department. In addition to establishing a baseline RR, the main reasons for repeated images were categorized, to determine the most frequent reasons for repeated images.

Methods

- A retrospective study assessing the electronic medical records.
- Radiation therapy patients imaged on the 9 conventional Linear Accelerators using cone beam CT, and simulated on the 3 CT units between September 1, 2020, and January 31, 2021.
- The date, treatment unit, site, patient identification number, and reason for repeated image were collected in the form of tallies on a password protected Microsoft Excel sheet.
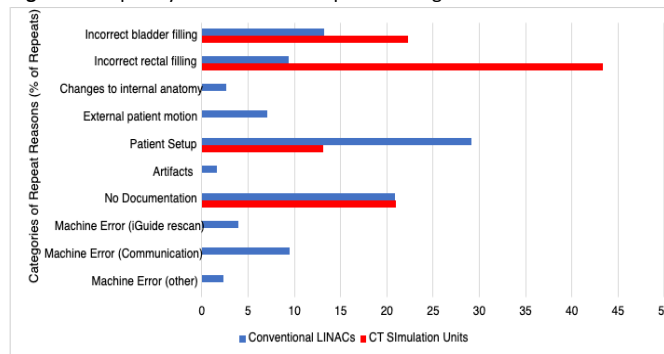- Data was assessed aggregately to determine RRs.

Results

Figure 1 Repeat Rates for the 9 Conventional LINAC Units and 3 CT Simulation Units
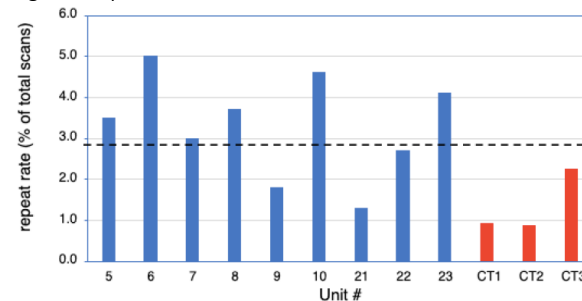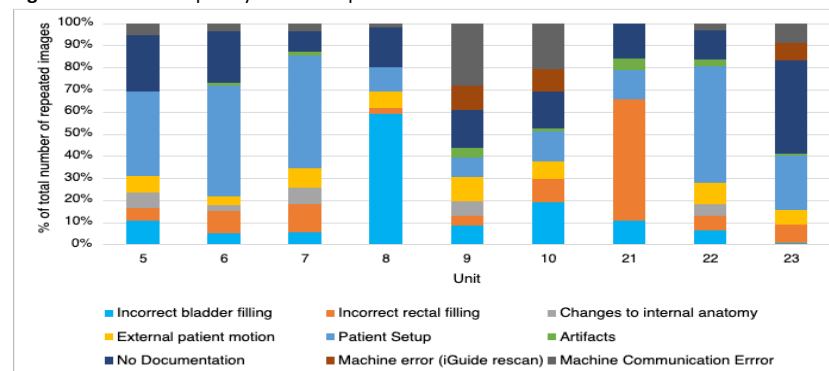

- Average RR = 2.9%

- Linear Accelerators RR = 3.3%

- CT Simulation Units RR = 1.5%

- Units 6 and 10 had the highest RRs of 5% and 4.6%, respectively.

Figure 2 Frequency of Reasons for Repeated Images

- Incorrect rectal filling accounts for 43.4% of CT simulation repeats

- Patient setup (29.2%) was the main reason for repeats on Linear Accelerators

Figure 3 Relative Frequency of Each Repeat Reason for the Linear Accelerator Units

Discussion

The average RR is lower than the accepted 10% in diagnostic imaging, but expected due to the less stringent requirements for image quality compared to diagnostic imaging. The higher RR on Linear Accelerators compared to CT units was also expected.

Patient scheduling typically causes similar treatment sites to be scheduled to specific units, increasing expertise on specific treatment sites for staff on the designated unit. This can result in higher rates of repeats on units which are more susceptible to repeat requirements due to certain patient populations. This can be seen with the breast units (5, 6 and 23). Increased communication errors were also observed on the units with the iGuide imaging feature (9, 10 and 23).

Incorrect rectal filling accounted for 43.4% of repeats on the CT simulation units. Bladder volume can be measured using a bladder scanner prior to the CT scan; however, rectal filling cannot, which may account for the higher frequency.

Documentation can be overlooked due to increased stress and lack of time. However, documented reasons for repeats are essential for RIA. A proper analysis is limited if there is a lack of ability to categorize reasons for repeats. Further evaluation for quality improvement strategies can be explored to improve documentation.

Conclusion

Repeat image analysis in the radiation therapy department at The Ottawa Hospital has provided a baseline RR and identified the frequency of reasons for repeated images.

There is potential to perform a RIA >5 months to further evaluate trends in frequencies and monthly RRs. At a minimum, this repeat image analysis has provided a foundation for continued follow-up to maintain efficiency in the departmental workflow.

This analysis has served as a basis to determine areas of focus for potential quality improvement initiatives.