Delivering radiation therapy treatments to patients is an incredibly complex process that consists of many hundreds of steps and involves multiple professional specialties.\(^1\) As with any process of this level of complexity, errors cannot be completely eliminated and do occasionally happen.\(^2\) It is the goal of many departments to find ways to prevent errors and to have processes in place to catch those errors that do occur before they reach the patient. Developing policies and procedures alone will not be enough to sufficiently reduce risks to our patients. Incident learning systems (ILS) are a great way for institutions to share knowledge about potential errors and facilitate an evaluation of where safety efforts might be best directed. This paper will analyze an error report from the Radiation Oncology Incident Learning System (RO-ILS) and describe some of the contributing factors as well as steps that can be taken to prevent this error.

Over the weekend a patient was brought to the radiation oncology department to initiate emergent whole brain irradiation. The staff, consisting of two radiation therapists and a radiation oncologist, performed the patient simulation, designed the treatment plan, and performed the dose calculations. The simulation was performed on the linear accelerator utilizing a clinical setup for the plan design. Anatomical measurements were taken to complete the necessary dose and monitor unit calculations. One of the therapists performed the measurement of the lateral separation of the patient’s head using calipers. The incorrect scale from the calipers was read by the therapist, recording the separation as 30cm. This error in separation measurement resulted in a combined deviation from prescribed dose, overdose, of 28% from both of the weekend treatments. On the following Monday during normal clinical operation, the medical dosimetrist that was generating the formal plan discovered the error.

The overdose of the patient for two treatments over the weekend is in large part a result of the actions of the two therapists. Research into ILS reported cases has found that “human factors” are associated with the more events than any other causal factor and contributes more often to high-risk events than to low-risk events.\(^2,3\) This certainly holds true for this reported event. Under the assumption that any existing policies and procedures were followed by the therapist, there appears to be room for improvement in these processes. The first area that seems
to have an obvious solution is designing a better process of measurement. In addition to ensuring that proper training is provided on emergency simulation procedures and equipment use, a simpler more specifically designed caliper tool with only one scale could have prevented this error.

High-risk process steps should command additional attention and scrutiny before proceeding. In this case, the second therapist present should independently measure and verify the separation. I am reminded of the process I witnessed as a radiation therapy student when simulating a patient for brain stereotactic radiosurgery. Part of the setup documentation involved taking depth measurements through a dome placed over the patients head while in the immobilizing mask. The many lettered locations were measured by the first simulation therapist using a depth rod with a measurement scale on it. These measurements were written down by the second therapist. They then switched places and re-measured and re-recorded each of the points. While these measurements were not used in plan calculations and were mainly for setup verification, they demonstrate a process of increased scrutiny for high-risk procedures.

My final point is about remaining focused on the task at hand and thinking critically about what you are doing. I believe that a part of any process should be a step directing the user to step back and look at the big picture. Does what you are doing and the information you are receiving make sense? This step is built in to many of the checklists used at my clinical site. Any one of the three professionals involved in planning this treatment could have questioned how large 30cm actually is and how it is approximately double the typical lateral separation of a patient’s head. This may have prompted them to recheck the measurement and discover the error. During the patient setup for treatment, the SSD could have been checked against the measurement used in monitor unit calculation for accuracy of both the initial measurement and setup of the patient for treatment. If instead they moved to the incorrect SSD following the setup instructions containing the error, they would have noticed that the table was obviously off center. They should have also realized that the opposing SSD was drastically different, indicating that the isocenter was not at midline as intended.

Events such as this demonstrate that while there has been considerable effort put forth by vendors and professional organizations to safeguard against technological errors, there is much to be gained by a systematic evaluation of error pathways. Participation in RO-ILS and other ILS with help to aggregate data and identify trends. They also provide a researched taxonomy
with which to better categorize and analyze causal factors leading to a better understanding of the incident processes. Limited time and resources of average departments can use this process to put their efforts towards the maximum gain so that high-risk events can be avoided. As with this case, simple solutions may be available once their unique risks are identified.

References:

