

Beyond TG119: Providing Multiple Institutional Planning and Dosimetry Comparisons for Stereotactic Radiosurgery Commissioning

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INTRODUCTION

Stereotactic radiosurgery (SRS) was historically delivered at a small number of facilities using specialized equipment and techniques. Today, more than half of radiotherapy facilities in the US are delivering SRS. Such rapid proliferation of a complex technique raises concerns regarding practitioner expertise, commissioning, and adherence to established quality assurance guidelines. The current widespread use of complex delivery techniques using conventional linacs, including single-isocenter multi-target VMAT, represents a significant increase in planning and delivery complexity and warrants additional attention.

AIM

We characterize the current state of SRS and advocate for a TG-119 equivalent test suite for SRS commissioning. This standardized planning and dosimetry comparison should include a collection of complex and clinically relevant plans, would improve our ability to accurately deliver SRS, and potentially mitigate future quality and safety incidents.

METHOD

We evaluated SRS practice patterns in the US and results from Imaging and Radiation Oncology Core (IROC) SRS phantom irradiation to identify current needs related to commissioning and quality assurance in SRS.

RESULTS

Over 1,000 facilities in the US currently deliver SRS. This number increased by 60% from 2004-2014 and currently includes nearly 500 dedicated SRS systems. The percentage of patients treated using linac-based SRS increased from 3% to >30% from 2003-2011 and continues to increase. In 2013, tolerances for the IROC SRS phantom were modified to 5%(point dose), and 85% gamma pass(5%/3mm). From 2013-present, phantom pass rates are 83% and 93% for linac and Gamma Knife, respectively.

REFERENCE SUPPORTING DATA

1) More than half of radiotherapy facilities in the US are delivering SRS.

From National Cancer Data Base (NCDB), from 2004 to 2014, the proportion of patients receiving SRS annually increased (from 9.8% to 25.6%; $P < .001$), and the proportion of facilities using SRS annually increased (from 31.2% to 50.4%; $P < .001$). [1]

2) Over 1,000 facilities in the US currently deliver SRS.

There are approximately 2,246 radiation therapy facilities in the US [2], and over half deliver SRS.[1]

3) US facilities delivering SRS increased by 60% from 2004-2014 and includes ~500 dedicated SRS systems.

From National Cancer Data Base (NCDB), from 2004 to 2014, the proportion of facilities using SRS annually increased (from 31.2% to 50.4%; $P < .001$). [1] From analysis of manufacturer websites, a database on dedicated SRS systems was compiled by location and included 428 identified systems in the US.[3]

4) The percentage of patients treated using linac-based SRS increased from 3% to >30% from 2003-2011.[6]

The National Cancer Data Base (NCDB) was used to identify patients undergoing linac or Gamma Knife SRS. The proportion of patients undergoing LINAC SRS increased from 3.2% in 2003 to 30.8% in 2011 ($p < 0.001$).[4]

5) From 2013-present, phantom pass rates are 83% and 93% for linac and Gamma Knife, respectively.

IROC pass rates for linac and GK were 79% and 96% from 2013-2016 [5], and 83% and 93% for 2013-present.[6]

CONCLUSIONS

IROC SRS phantom results reveal a substantial fraction of facilities failing to meet relatively lenient dosimetric tolerances for a relatively simple target. Numerous high profile treatment deviations associated with SRS delivery have already occurred. We propose that a standardized SRS planning and dosimetry comparison, including a suite of complex and clinically relevant plans, would improve our ability to accurately deliver SRS, and potentially mitigate future quality and safety incidents.

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