

Examining the compatibility of Versa HD to safely be used for treating multi-lesion brain cases

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Introduction

Treating multi-lesion SRS cases are some of the most demanding cases technologically. Traditionally the gold-standard for these cases are the GammaKnife™ or CyberKnife™ radiosurgery platforms. However, many centers have conventional linear accelerators with imaging and delivery capabilities which could improve access to care if used for these treatments.

This study investigated the feasibility of using an Elekta VersaHD linear accelerator to delivery a single-fraction treatment to 5 lesions.

Methods

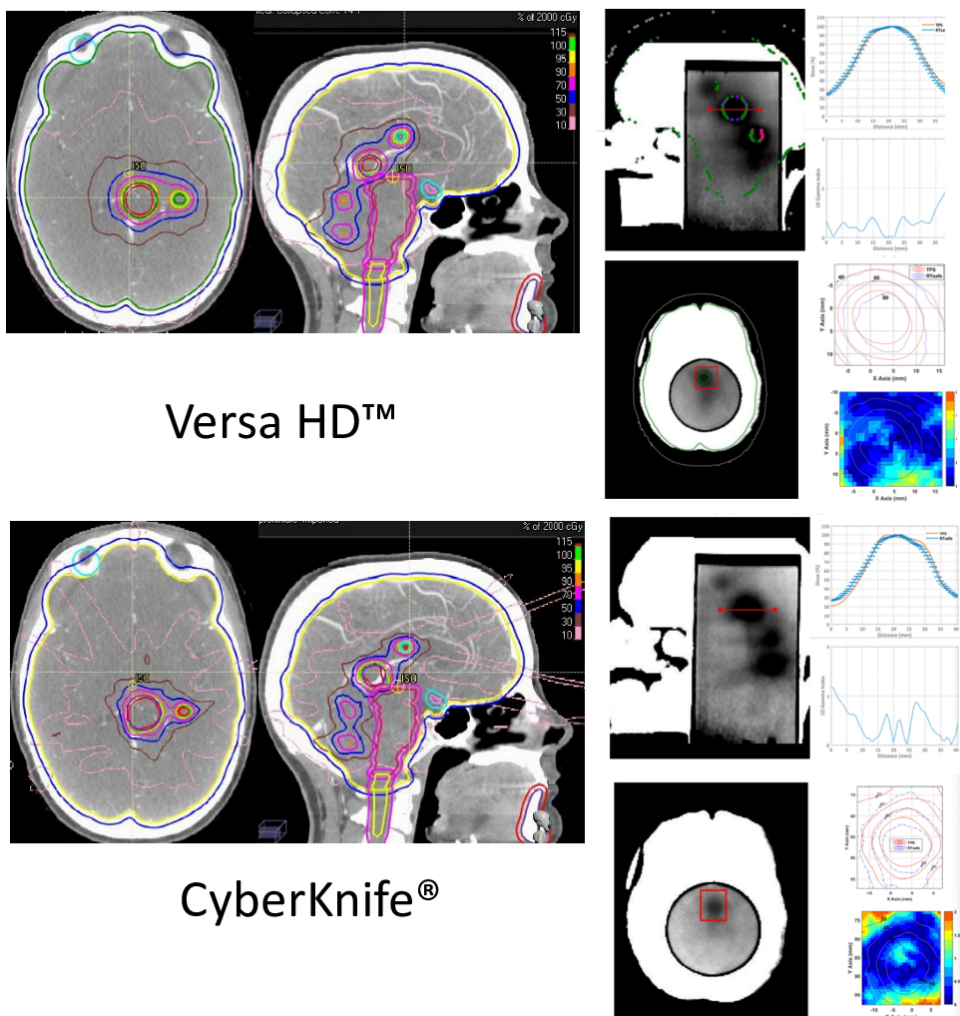
A digital phantom was provided by RTsafe P.C. (Athens, Greece). 5 lesions were artificially added throughout the brain that ranged from 7 mm up to 20 mm in diameter. Single fraction plans delivering 20 Gy to each lesion were created for the Versa HD™ using the RayStation (RaySearch Laboratories, Stockholm, Sweden Version 8A) treatment planning system (TPS) with all lesions within 6 cm of the isocenter. CyberKnife® plans were created using the Precision® TPS (Accuray®, Madison, WI).

A corresponding 3D-printed physical phantom with 2 gel inserts was provided for irradiation (PseudoPatient®, RTsafe, Athens, Greece).

Post-irradiation, the phantoms were imaged with a specially designed MRI sequence to extract the change in gel density which was analyzed by RTsafe. A report was provided containing dose profiles, DVH information, and 2D and 3D gamma pass rates.

The Elekta Versa HD™ can deliver multi-lesion SRS plans with comparable dosimetry to the Accuray CyberKnife® for lesions of 9 mm diameter or larger

Results



Versa HD™

CyberKnife®

Table 1. Results for the 3D gamma index test, comparing gel-measured (reference) with the TPS-calculated (evaluated) dose distributions using DTA/DD of 2mm/3% passing criteria.

Structure	Passing rate (GI ≤ 1) (%)	
	Cyberknife	Versa HD
PTV1 - 7mm	97.1	87.8
PTV2 - 9mm	99.3	96.8
PTV3 - 12mm	99.0	95.6
PTV4 - 20mm	95.5	98.5
PTV5 - 15mm	99.0	98.7

All targets had measured mean dose <2% of planned dose

Discussion

Full 3D dosimetry is possible for complicated treatment procedures. The Versa HD™ provided clinically acceptable accuracy for lesions 9 mm or greater. Future efforts will extract information regarding the brain V12Gy <10 cc constraint and to improve workflow.