

Impacts of Anatomical Features on Dosimetry and Outcome of Trigeminal Neuralgia Stereotactic Radiosurgery

Dandan Zheng ¹

1. Radiation Oncology, University of Nebraska Medical Center

✉ **Corresponding author:** Dandan Zheng, sabrinadan@gmail.com

Categories: Medical Physics, Radiation Oncology

Keywords: sbrt, srs, stereotactic radiosurgery

How to cite this abstract

Zheng D (November 02, 2017) Impacts of Anatomical Features on Dosimetry and Outcome of Trigeminal Neuralgia Stereotactic Radiosurgery. *Cureus* 9(11): a276

Abstract

Objectives: To evaluate the impacts of patient anatomical variables on dosimetry and outcome of trigeminal (TN) SRS on 40 patients. Patients were treated with LINAC-based TN SRS with 90 Gy to maximum dose, delivered using 7 non-coplanar conical arcs of 5-6 mm diameter. Five anatomical variables were studied including nerve incident angle to brainstem surface (A), nerve length (L), distance between isocenter and brainstem along the nerve (D), nerve axial width (WA), and nerve sagittal width (WS).

Methods: On fused planning images (1.2 mm CT and 1 mm cisternogram), the 5 anatomical variables were extracted as model inputs. Dose endpoints (outputs) were calculated including maximum brainstem dose (BSmax), volume of brainstem receiving at least 10 Gy (V10BS), and volume of normal tissue receiving at least 12 Gy (V12). Each output variable was fitted with the 5 input variables using Multiple Linear Regression (MLR) to assess correlations and select the best output. Input variables were also selected by applying Gaussian graphic model LASSO. On clinical outcome, pain relapse before 2 years post SRS and facial numbness were used to calculate odds ratios for patients with below and above median-value A (the small A group vs. the large A group). R was used for all statistical analyses.

Results: Median BSmax, V10BS, and V12 for the 40 patients was 35.7 Gy, 0.14 cc, and 0.96 cc, respectively. Median A, L, D, WA and WS was 43.7 degree, 8.8 mm, 4.8 mm, 2.8 mm and 2.7 mm, respectively. MLR analyses showed R² of 0.70, 0.37, and 0.10 for BSmax, V10BS, and V12, respectively, indicating BSmax as the best dosimetric output variable. During MLR, input variable A was found most significant, with a P-value of 3.2E-6 and 0.005 for BSmax and V10BS fitting, respectively. This result agreed with the highest single linear regression R² BSmax has with A, at 0.43, among all input variables. The low MLR correlation for V12 also agreed with the fact that V12 is more dictated by cone size than anatomy. LASSO identified an optimal 3-input model with A, D, and WA for BSmax and V10BS. The small angle A group calculated an odds ratio of 1.6 (confidence interval CI=0.2-10.7) for pain relapse and that of 2.4 (CI=0.5-11.5) for facial numbness, compared with the large A group.

Conclusions: Anatomical variables among different TN patients were found to impact brainstem doses from LINAC-cone-based SRS. MLR analyses established reasonably strong correlation models between anatomical variables and brainstem doses. Nerve angle, width and iso-BS distance were identified as the major anatomical variables among which nerve angle A was most significant. A higher odds ratio for pain relapse and facial numbness was indicated for

Open Access

Abstract

Published 11/02/2017

Copyright

© Copyright 2017

Zheng. This is an open access article distributed under the terms of the Creative Commons Attribution License CC-BY 3.0., which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Distributed under

Creative Commons CC-BY 3.0

patients with more acute nerve angles relative to brainstem.