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Abstract

Frameless Radiosurgery with Gamma Knife Icon: Initial Clinical Experience

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Objectives: New Gamma Knife Icon provides a frameless radiosurgery treatment option based on new mask and cone beam CT system. Our aim is to present our clinical protocol/pathway concerning 404 patients treated in a frameless setup between May 2017 - September 2019 with either single or multi fraction radiosurgery.

Methods: Gamma Knife Icon system provides a moldable cushion and a thermoplastic mask system placed on a carbon fiber extension attached to the couch. Treatment preparation starts with molding the cushion and the mask followed by a "High 6.3 CTDI" mode cone beam computed tomography (CBCT) scan, which is used for a co-registration with volumetric magnetic resonance and standard computerized tomography images. After the plan is created, obtaining a localizer "Low 2.5 CTDI" CBCT scan is essential before the start of the treatment as well as it confirms the positional accuracy. During the delivery, the intrafraction motion management (IFMM) camera tracks the movement of the patient.

Results: Of 404 patients, 252 had benign tumors, 103 had metastases, 41 had arteriovenous malformations and eight had other malign tumors (glioblastoma, medulloblastoma, chordoma). Median age was 53 years (11-89 years). The number of patients who received single-fraction and multi-fraction treatment were 42 and 362, respectively. Single-fraction mask therapy was preferred for patients who denied rigid frame system, having craniotomy defects, using antiaggregant drugs, or being allergic to local anestesic agents. Lesion size ranged from 0.1 to 84 cc in volume. All patients completed their treatments in 1 to 5 fractions as planned, except for two cases with large arteriovenous malformations, who received 10-fraction-treatment each.

Conclusions: Single or multi-fraction frameless stereotactic radiosurgery may provide an alternative treatment option for the treatment of large tumors, tumors adjacent to radiosensitive anatomical structures or patients with certain limitations for stereotactic frame. Additional studies have to be conducted to expand the use of non-invasive frameless treatment option without compromising dose delivery advantages of standard frame-based Gamma Knife treatment.

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