Case Report: ADAPTIVE RADIOSURGERY

Stieler et al. (2016) “Adaptive fractionated stereotactic Gamma Knife radiotherapy of meningioma using integrated stereotactic cone-beam-CT and adaptive re-planning (a-gKFSRT)”  
*Strahlentherapie und Onkologie, July, pp. 1-5.*

- 76 year old female, refused surgery
- Benign meningioma; Large, WHO Grade 1, left petrous bone
- Adaptive fractionated treatment with mask, chosen due to larger tumor volume, location and proximity to critical structures
**WORKFLOW**

7 days prior to treatment

**Treatment: 25Gy in 5 fractions over 5 days**

- MRI-based pre-plan
- CT: verify tumor position. Co-registration MRI / CT. Pre-plan adaptation.
- Mask-based immobilization

- CBCT to verify actual skull position. Automatic co-registration to determine daily shift in translation and rotation. Automatic adaption by TPS to daily position; recalculation of dose distribution.

Repeated at fraction 2-5
Outcome

› ‘Adaptive daily re-planning was accurate and yielded quality measures, e.g., coverage, selectivity, and gradient for the delivered dose identical to the initial values’

› Treatment well tolerated (slight headache after 1st treatment resolved with dexamethasone)

› No neurological symptoms at 6 weeks and 4 month follow-up

Details

• Prescribed to 46% isodose line for improved coverage and optimal treatment time

• Total treatment time for each session around 20 mins
  - Patient positioning 0.8mins
  - CBCT plus acquisition 1.65mins
  - CT data processing and adaptive planning 2.66mins
  - Treatment 15.6mins

• Differences for the five daily CBCTs compared to reference:
  - For rotation:-0.59±0.49°/0.18±0.20°/0.05±0.36°
  - For translation:0.94±0.52mm/-0.08±0.08mm/-1.13±0.89mm
  - The TPS automatically adapted the shot positions to the daily position and recalculated the dose distribution (online adaptive planning)

• Over all fractions an intrafractional movement of 0.13 ± 0.04mm noted
Dose distribution based on Cone Beam CT

The isodose lines represent the following doses (outer to inner lines): 5 Gy, 12 Gy, 25 Gy, and 50 Gy.

Intra-fractional movements

Shown are the measurements (in mm) of the HDMM (high-definition motion management) over time. On days 2 and 3, no intrafractional movement was detected.