

## Spinal Re-irradiation by Stereotactic Body Radiotherapy (SBRT): Safety and Efficiency

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### Abstract

**Objectives:** Due to precise and high conformal dose delivery, SBRT is the optimal treatment modality for spine metastasis re-treatment when conventional radiotherapy is unable to be within the spinal dose tolerance. We investigated the safety and clinical efficiency of spine SBRT of previously irradiated patients. We provided a preliminary analysis on the cumulative spinal cord dose, local tumor control and toxicities.

**Methods:** Between July 2011 and December 2015, dosimetric and clinical data from 55 patients treated for spinal metastases after prior radiation with robotic SBRT were reviewed. The maximal spinal cord and esophagus dose points in both plans were localized, cumulated and converted to equivalent total dose in 2Gy fractions (EQD2) with an alpha/beta ratio of 3. Patient data and tumor characteristics were obtained using retrospective chart review.

**Results:** Fifty-five patients were treated for 61 re-irradiations. Median age was 69 (range: 36-81). Main primary tumor sites were breast (35.5%), kidney (21%) and lung (12.9%). Primitive tumor was controlled in 85.5% of patients. Median time between first and second courses of radiation was 28 months (range: 1-330). One patient was at his third radiation course including 2 SBRT re-treatments in the lombo-sacral area. Patients were addressed to spine SBRT re-irradiation for pain relief (79%), local control intent (53.2%) or neurological issue (42%). 24 spinal metastases out of 61 (39%) were epidural spinal cord compressions. The most frequently prescribed dose at re-irradiation was 25 Gy in 5 fractions. Median EQD2 dose and biologically effective dose (BED) to tumor at re-irradiation were 40 Gy (range 16.7-68.6 Gy) and 48 Gy (range 20-82.3 Gy) respectively. Median cumulative maximal dose point in term of EQD2 to spinal cord, thecal sac and esophagus, was 47.1 Gy (range: 42-138 Gy), 50 Gy (range: 35.5- 77.6 Gy), 58 Gy (range: 28.9-94.5 Gy) respectively. Median cumulative max dose point in term of BED to the previous cited organs was 77.9 Gy (range: 50 ? 230 Gy), 83 Gy (range: 56.3- 129 Gy), 96.6 Gy (range: 25-127.5 Gy), respectively. Mean time to recurrence was 30.5 months (IC95%23.8-37.3). Longer spinal tumor control was observed for breast compared to renal tumors with a median of 38.7 months (IC95% 28-45.3) and 15.8 months (IC95%9.2-22.4) respectively. Longer survival to recurrence was obtained for prescribed dose in term of EQD2 above 32Gy (36.2 months, IC95%28.7-43.6, p<0.002) without added toxicity. With a median follow-up of 11 months (range: 1-48 months), 76.3% of painful lesions were improved, 79.7% kept local control and 84.7% of patients addressed for neurological challenge had no neurological worsening with 20% of these patients presenting a clinical neurological

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recuperation. Acute toxicities were minimal. There were no cases of radiation myelopathy.

Conclusions: Spine SBRT following prior radiation is a safe therapeutic option in selected patients, allowing a good clinical efficacy not only on local control but also on pain or neurological symptom relief. Nevertheless to avoid toxicity, this technique requires an accurate dosimetric evaluation. This study, in spite of cautious cumulative doses delivered to the spinal cord, tends to demonstrate a dose-effect. As re-irradiation dose constraints are not well established so far, further dosimetric and clinical evaluations are required to optimize tumor and critical organs delivered doses in spinal retreatment.