

MR-Guided Laser-Induced Interstitial Thermotherapy of Recurrent Glioblastoma

F. Eickmeyer¹, H.-J. Schwarzmaier², W. von Tempelhoff³, V. U. Fiedler¹, N. Hendrik⁴, S. D. Ulrich³, F. Ulrich³

¹Radiology, Klinikum Krefeld, Krefeld, Germany, ²Medical Technology, Klinikum Krefeld, Krefeld, Germany, ³Neurosurgery, Klinikum Krefeld, Krefeld, Germany,

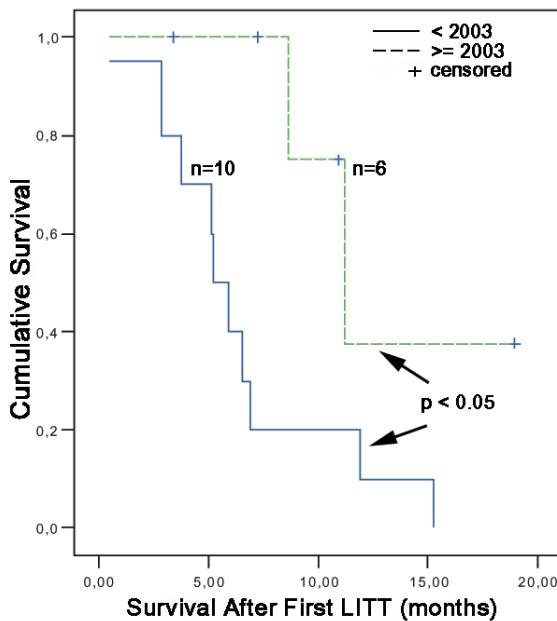
⁴Neurosurgery, Klinikum Krefeld, Krefeld, Germany

Rational: The prognosis of a recurrent glioblastoma is poor. Although new chemotherapy regimens have recently been introduced, the median survival of these patients is reported to be between 5.8¹ and 6.9² months. Therefore, new therapies are required. In this study, we employed laser-induced interstitial thermotherapy (LITT)³ for a partial cytoreduction of these tumors.

Patients: In total, 16 patients (mean age 57 ± 10 y) were treated by interstitial laser irradiation. All patients suffered from a histologically confirmed recurrent glioblastoma grade IV WHO and were non-surgical candidates. In all patients, at least one laser treatment (range 1-4) was performed. In addition, all patients received a systemic chemotherapy.

Methods: For laser irradiation, we used a Nd:YAG laser ($\lambda=1064$ nm, cw, 4060 N, Dornier Medizintechnik, Germering, Germany)³. The light was transmitted via a light guide ending in an optical diffusing tip (LITT Standard Applikator, Trumpf, Ulm, Germany) which was positioned in the center of the tumor. The mean energy delivered per laser session was 4.5 ± 0.7 kJ. Laser therapy was guided by MR-imaging (SIGNA SP/i, General Electric, Milwaukee, WI)⁴. For the positioning of the light guide, the built-in localization system (Flashpoint 3000, IGT, Boulder, CO) was used. Thermal therapy was guided by MR thermometry using an experimental software package based on the phase shift technique.

Figure 1: Survival after LITT



Results: All patients tolerated the procedure well and there was no in-hospital lethality. Major complications were not observed. After the exclusion of the data from the learning curve (patients treated before 2003; median survival 5.2 ± 0.6 months), the median survival of the patients after the first LITT was 11.2 ± 2.0 months (patients treated in 2003 and later, Kaplan-Meier method; see figure 1). Follow-up MR examinations exhibited a volume decrease of the irradiated parts of the tumors (see figure 2). The cause of death was in most cases related to adverse effects of chemotherapy and/or corticosteroids.

Conclusion: Cytoreduction using LITT is feasible and safe in recurrent glioblastoma multiforme. The data exhibited a tendency towards an increased survival. However, controlled clinical trials are required to define the role of LITT in the clinical management of recurrent glioblastoma.

References

1. Wong et al.: J Clin Oncol 1999, 17(8):2572
2. Brandes et al.: Oncology 2000, 59:181
3. Schwarzmaier et al.: Med Laser Appl 2002, 17:147
4. Kettenbach et al.: J Magn Reson Imag 1998, 8:933



Figure 2: Recurrent glioblastoma; a) before, b) five days after LITT, and c) eight months after LITT