Stereotactic brachytherapy for glioblastoma

There has been a resurgence of interest in brachytherapy as a treatment for glioblastoma, with several currently ongoing clinical trials. To provide a foundation for the analysis of these trials, we analyze the Surveillance, Epidemiology, and End Results (SEER) database to determine whether receipt of brachytherapy conveys a survival benefit independent of traditional prognostic factors.

We identified 60,456 glioblastoma patients, of whom 362 underwent brachytherapy. We grouped patients based on receipt of brachytherapy and compared clinical and demographic variables between groups using Student's t-test and Pearson's chi-squared test. We assessed survival using Kaplan-Meier curves and Cox proportional hazards models.

Median overall survival was 16 months in patients who received brachytherapy compared to 9 months in those who did not (log-rank $p < 0.001$). Patients who underwent brachytherapy tended to be younger ($p < 0.001$), suffered from smaller tumors (< 4 cm, $p < 0.001$), and were more likely to have undergone gross total resection (GTR, $p < 0.001$). In univariable Cox models, these variables were independently associated with improved overall survival. Additionally, improved survival was associated with known receipt of chemotherapy (HR 0.459, $p < 0.001$), external beam radiation (HR 0.447, $p < 0.001$), and brachytherapy (HR 0.637, $p < 0.001$). The association between brachytherapy and improved survival remained robust (HR 0.859, $p = 0.031$) in a multivariable model that adjusted for patient age, tumor size, tumor location, GTR, receipt of chemotherapy, and receipt of external beam radiation.

Our SEER analysis indicates that brachytherapy is associated with improved survival in glioblastoma after controlling for age, tumor size/location, extent of resection, chemotherapy, and external beam radiation [1)].

Stereotactic brachytherapy (SBT) has been described in several publications as an effective, minimal invasive and safe highly focal treatment option in selected patients with well circumscribed brain tumors <4 cm. However, a still ongoing discussion about indications and technique is hindering the definition of a clear legitimation of SBT in modern brain tumor treatment. These controversies encompass the question of how intense the irradiation should be delivered into the target volume (dose rate). For instance, reports about the use of high does rate (HDR) implantation schemes (>40 cGy/h) in combination with adjuvant external beam radiation and/or chemotherapy for the treatment of malignant gliomas and metastases resulted in increased rates of radiation induced adverse tissue changes requiring surgical intervention. Vice versa, such effects have been only minimally observed in numerous studies applying low dose rate (LDR) regiments (3–8 cGy/h) for low-grade glioma s, metastases and other rare indications. Besides these observations, there are, however, no data available directly comparing the long term incidences of tissue changes after HDR and LDR and there is, furthermore, no evidence regarding a difference between temporary or permanent LDR implantation schemes. Thus, recommendations for effective and safe implantation schemes have to be investigated and compared in future studies.

Salvage SBT is feasible and safe even after previously performed external beam radiation. Favorable outcome measurements in particular for grade III recurrences deserve further prospective evaluation [2)].

1)

Bartek J Jr, Alattar AA, Dhawan S, Ma J, Koga T, Nakaji P, Dusenbery KE, Chen CC. Receipt of brachytherapy is an independent predictor of survival in glioblastoma in the Surveillance, Epidemiology, and End Results database. J Neurooncol. 2019 Aug 30. doi: 10.1007/s11060-019-03268-y. [Epub ahead of print] PubMed PMID: 31471790.

2)

Schwartz C, Romagna A, Thon N, Niyazi M, Watson J, Belka C, Tonn JC, Kreth FW, Nachbichler SB. Outcome and toxicity profile of salvage low-dose-rate iodine-125 stereotactic brachytherapy in recurrent high-grade gliomas. Acta Neurochir (Wien). 2015 Aug 23. [Epub ahead of print] PubMed PMID: 26298594.