Multiple Brain Metastases Treatment

Neurosurgery, stereotactic surgery, and Whole brain radiotherapy are the evidence-based treatments that can be applied for patients with multiple brain metastases. Treatment with chemotherapy and molecularly targeted agents may also be warranted. Several experimental treatments are emerging, one of which is electrochemotherapy (ECT), an effective cancer treatment comprising electric pulses given by electrodes in the tumor tissue, causing electroporation of the cell membrane, and thereby augmenting uptake and the cytotoxicity of the chemotherapeutic drug bleomycin by 300 times. Preclinical data are promising and the first patient has been treated in an ongoing clinical trial for patients with brain metastases. Perspectives for ECT in the brain include treatment of primary and secondary brain tumors as well as soft tissue metastases elsewhere ¹⁾.

Radiosurgery has demonstrated good safety and efficacy in the treatment of multiple brain metastases (BMs). However, multi-target dose planning can be challenging and time-consuming. A recently developed real-time inverse treatment planning (IP) by convex optimization has been demonstrated to produce high-quality treatment plans with good conformity and selectivity in singletarget plans. We intended to test the capacity of this IP to rapidly generate efficient plans while optimizing the preservation of normal tissue in multiple BM.

Methods: Seventy-nine patients (mean age 62.4, age range 22-85) with a total of 272 BMs were treated by Gamma Knife Radiosurgery. All subjects were treated using a forward planning (FP) technique by an expert neurosurgeon. The new Intuitive Plan was applied and able to automatically generate an alternative plan for each patient. All planning variables were collected from the IP to be compared with the corresponding measurements obtained from the FP. A paired sample t test was applied to compare the 2 plans for the following variables: brain volumes receiving 10 Gy (V10) (primary endpoint), and 12 Gy (V12), planning indices (selectivity, coverage, gradient, and Paddick Conformity Index [PCI]), beam-on time (BOT), and integral doses. Additionally, the noninferiority margin for each item was calculated, and the 2 plans were compared for noninferiority using a paired t test.

Results: The mean age of patients was 62.4 years old (age range 22-85), with a sex ratio of 1.02. The average number of lesions per patient was 3.4 (range 1-12). The mean prescription dose was 21.46 Gy (range 14-24 Gy). Noninferiority of the IP was concluded for V10, V12, prescription isodose volume, BOT, PCI, and selectivity. The V10 (and V12) was significantly lower with the IP (p < 0.001). These volumes were 8.69 cm3 ± 11.39 and 5.47 cm3 ± 7.03, respectively, for the FP and 7.57 cm3 ± 9.44 and 4.78 cm3 ± 5.86 for the IP. Only the coverage was significantly lower with the IP (-2.3%, p < 0.001), but both selectivity (+17%) and PCI (+15%) were significantly higher with the IP than FP (p < 0.001).

Conclusion: This IP demonstrated its capacity to generate multi-target plans rapidly, with a dose to the brain (V10) and BOT noninferior to the one of a human expert planner. These results would benefit from confirmation in a larger prospective series $^{2)}$

With the development of therapies that improve extracranial disease control and increase long-term survival of patients with metastatic cancer, effective treatment of brain metastases while minimizing toxicities is becoming increasingly important. An expanding arsenal that includes surgical resection,

whole brain radiation therapy, radiosurgery, and targeted systemic therapy provides multiple treatment options. However, significant controversies still exist surrounding appropriate use of each modality in various clinical scenarios and patient populations in the context of cancer care strategies that control systemic disease for increasingly longer periods of time. While whole brain radiotherapy alone is still a reasonable and standard option for patients with multiple metastases, several randomized trials have now revealed that survival is maintained in patients treated with radiosurgery or surgery alone, without upfront whole brain radiotherapy, for up to four brain metastases. Indeed, recent data even suggest that patients with up to 10 metastases can be treated with radiosurgery alone without a survival detriment. In an era of dramatic advances in targeted and immune therapies that control systemic disease and improve survival but may not penetrate the brain, more consideration should be given to brain metastases-directed treatments that minimize long-term neurocognitive deficits, while keeping in mind that salvage brain therapies will likely be more frequently required. Less toxic therapies now also allow for concurrent delivery of systemic therapy with radiosurgery to brain metastases, such that treatment of both extracranial and intracranial disease can be expedited, and potential synergies between radiotherapy and agents with central nervous system penetration can be harnessed ³⁾.

1)

Linnert M, Iversen HK, Gehl J. Multiple brain metastases - current management and perspectives for treatment with electrochemotherapy. Radiol Oncol. 2012 Dec;46(4):271-8. doi: 10.2478/v10019-012-0042-y. Epub 2012 Nov 9. PMID: 23412694; PMCID: PMC3572894.

Beltaifa Y, Hamdi H, Spatola G, Balossier A, Merly L, Castillo L, Cretol A, Regis J. Is Real-Time Inverse Planning Optimizing Dose to the Normal Brain? A Prospective Comparative Trial in a Series of Brain Metastases Treated by Stereotactic Radiosurgery. Stereotact Funct Neurosurg. 2021 Nov 24:1-8. doi: 10.1159/000519024. Epub ahead of print. PMID: 34818656.

Shen CJ, Lim M, Kleinberg LR. Controversies in the Therapy of Brain Metastases: Shifting Paradigms in an Era of Effective Systemic Therapy and Longer-Term Survivorship. Curr Treat Options Oncol. 2016 Sep;17(9):46. Review. PubMed PMID: 27447703.

From: https://neurosurgerywiki.com/wiki/ - Neurosurgery Wiki

Permanent link: https://neurosurgerywiki.com/wiki/doku.php?id=multiple_brain_metastases_treatmer



Last update: 2024/06/07 02:51