Electrochemotherapy

Electrochemotherapy is a antitumor treatment that combines systemic bleomycin with electric pulses delivered locally at the tumor site. These electric pulses permeabilize cell membranes in the tissue, allow bleomycin delivery diffusion inside the cells, and increase bleomycin cytotoxicity. Previous clinical studies have demonstrated the effectiveness of electrochemotherapy in the treatment of several primary and metastatic solid tumors.

Cindrič et al., developed a novel approach to treat spinal metastases, that is, transpedicular approach that combines electrochemotherapy with already established technologies for insertion of fixation screws in spinal surgery. In the transpedicular approach, needle electrodes are inserted into the vertebral body through pedicles and placed around the tumor.

The main goal of the study was to numerically investigate the feasibility of the proposed treatment approach. Three clinical cases were used in this study-1 with a tumor completely contained within the vertebral body and 2 with tumors spread also to the pedicles and spinal canal. Anatomically accurate numerical models were built for all 3 cases, and numerical computations of electric field distribution in tumor and surrounding tissue were performed to determine the treatment outcome. Complete coverage of tumor volume with sufficiently high electric field is a prerequisite for successful electrochemotherapy. Close to 100% tumor coverage was obtained in all 3 cases studied. Two cases exhibited tumor coverage of >99%, while the coverage in the third case was 98.88%. Tumor tissue that remained untreated was positioned on the margin of the tumor volume. We also evaluated hypothetical damage to spinal cord and nerves. Only 1 case, which featured a tumor grown into the spinal canal, exhibited potential risk of neural damage. Our study shows that the proposed transpedicular approach to treat spinal metastases is feasible and safe if the majority of tumor volume is contained within the vertebral body. In cases where the spinal cord and nerves are contained within the margin of the tumor volume, a successful and safe treatment is still possible, but special attention needs to be given to evaluation of potential neural damage [1)].

Treatment planning for electrode positioning and electrical pulse parameters was prepared for 4 needle electrodes. Mini-open surgery with a left L5 laminectomy was performed to introduce the electrodes. The patient was treated according to the established Electrochemotherapy Protocol with Bleomycin. Clinical efficacy of electrochemotherapy was evaluated according to a visual analog scale of pain, Oswestry Disability Index 2.0, the Karnofsky Performance Scale, and Response Evaluation Criteria in Solid Tumors.

The assessed follow-up period was 48 months after the electrochemotherapy procedure. Neither serious electrochemotherapy-related adverse events, nor bleomycin toxicity were reported. Overall improvement in pain according to Oswestry Disability Index 2.0 and Karnofsky Performance Scale outcomes was better.

This case represents, the first one to test the potential role of electrochemotherapy as treatment of spinal metastasis. Electrochemotherapy allowed a successful treatment of metastatic spinal melanoma. However, we believe that there is a strong scientific rationale to support the potential utility of electrochemotherapy as a novel treatment of spinal metastasis, regardless of the histological types [2)].

Electrochemotherapy allowed a successful treatment of metastatic spinal melanoma. There is a strong scientific rationale to support the potential utility of Electrochemotherapy as a novel treatment of spinal metastasis, regardless of the histological types [3].

1)
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