The Biber Protocol ®

Electrical Stimulation and Cancer UPDATE

The most recent evidence demonstrates a clear acceptance within the scientific community that not only is NMES *not* a risk but rather a clear benefit.

1. J Surg Oncol. 2016 Jul;114(1):27-31. doi: 10.1002/jso.24265. Epub 2016 May 4.
Neuromuscular electrical stimulation improves radiation-induced fibrosis through Tgf-B1/MyoD homeostasis in head and neck cancer.
Peng G1, Masood K2, Gantz O1, Sinha U1.

The study includes 30 patients with pre and post intropeative muscle biopsy for evidence of fibrotic tissue and uses NMES combined with traditional dysphagia therapy with statistically significant benefit.

2. Head Neck. Oct 2012; 34(10): 1428–1433.

Murine model of neuromuscular electrical stimulation on squamous cell carcinoma: Potential implications for dysphagia therapy
Gary Linkov, BS,1 Ryan C. Branski, PhD,2 Milan Amin, MD,2 Natalya Chernichenko, MD,1 Chun-Hao Chen, MD,1 Gad Alon, PhD,3 Susan Langmore, PhD,4 Richard J. Wong, MD,1 and Dennis H. Kraus, MD1,*

Background
Dysphagia is a potential consequence of treatment for head and neck cancer. Neuromuscular electrical stimulation (NMES) has evolved as a treatment option, with the goal of improved swallow function in patients with chronic dysphagia. However, the effects of NMES on tumorigenicity are unknown and often confound the initiation of this therapy, potentially limiting its efficacy in treating patients with head and neck cancer.
Methods
Squamous cell carcinoma was grown in the flank of athymic, nude mice. Mice were randomized into treatment and control groups; the experimental group received daily NMES directly to the flank for 8 days.
Results
Tumor volumes, recorded on days 0, 3, 7, and 10, demonstrated no significant differences between groups on each day of measurement. Immunohistochemical analysis of apoptosis, proliferation, and vascularization also failed to demonstrate statistically significant differences between treated and untreated groups.
Conclusions
NMES does not promote the growth of underlying tumor in our model. These data may provide preliminary evidence that applying electrical stimulation over the muscles of the anterior neck does not increase the risk of tumorigenicity.
Early initiation of NMES in this challenging population may be feasible from an oncologic standpoint.

3. Okino M, Mohri H
First Department of Surgery, Yamaguchi University School of Medicine.

Japanese Journal of Cancer Research : Gann [1987, 78(12):1319-1321]
Type: Journal Article

Application of a high-voltage electrical impulse (5 kV/cm, 2 msec) after bleomycin administration resulted in a significant size decrease of subcutaneously inoculated AH-109A hepatocellular carcinoma in Donryu rats. The tumor size decreased to an average of 17% of the initial mass 4 days after the treatment. Neither the high-voltage electrical impulse nor bleomycin administration alone showed an inhibitory effect on the tumor growth. I**t was concluded that the concomitant use of a high-voltage electrical impulse and an anticancer drug has the potential to be applicable for cancer treatment.**

4. Tumor Growth Retardation, Cure, and Induction of Antitumor Immunity in B16 Melanoma-bearing Mice by Low Electric Field-enhanced Chemotherapy

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Purpose: The exposure of cells in vitro to trains of low voltage-pulsed electric fields in the range of 20–100 V/cm was previously shown to induce an efficient uptake of macromolecules with molecular weight in the range of Mr 300–2,000,000 via an endocytic-like process. This study examines the antitumor effectiveness of treatment based on similar exposure of solid tumors in mice to low electric fields (LEFs) in the presence of chemotherapeutic agents.
Experimental Design: LEF was applied to ~5 mm in diameter (60–70 mm3) s.c. B16-F10.9 melanoma tumors by percutaneously placed electrodes after intratumoral injection of either cis-platinum(II) diamminedichloride, Taxol, 5-fluorouracil, or bleomycin.
Results: Significant eradication of primary tumors, prolongation of survival, and complete cure of some of the C57Bl/6 mice from both primary tumors and metastases were achieved using this technique with cis-platinum(II) diamminedichloride, bleomycin, and Taxol (13.5, 8, and 26% cure rate, respectively). Mice cured by LEF-enhanced chemotherapy and challenged with a tumorigenic dose of B16-F10.9 cells lived significantly longer than first time inoculated ones, and 23.5% of the challenged mice did not develop tumors at all. Spleen cells from the cured mice that were inoculated together with B16-F10.9 cells inhibited the primary tumor growth in intact mice. Histological analysis of tumor sections of LEF-enhanced chemotherapy-treated mice revealed multiple necrotic areas, apoptosis, and massive infiltrates of T lymphocytes and macrophages. **Low voltage electrochemotherapy with Taxol was shown to be more effective than surgical removal of the tumor with Taxol.**
Conclusions: These findings indicate that LEF-enhanced chemotherapy is an effective treatment of animals bearing metastatic melanoma.