Therapeutic Electromagnetic Field Effects on Angiogenesis During Tumor Growth

C. Douglas Williams and Marko S. Markov
EMF Therapeutics, Inc., 1200 Mountain Creek Rd., Suite 160,
Chattanooga, Tennessee, USA

INTRODUCTION

Angiogenesis, defined as the process of formation and differentiation of vasculature, is a key factor in the maintenance and progression of several diseases, such as cancer, diabetic neuropathy and macular degeneration. Antiangiogenic therapy is a relatively novel approach to the treatment of these diseases.

While electromagnetic fields have been applied to various injuries and pathologies in the musculo-skeletal system, few studies report the application of magnetic/electromagnetic fields for treatment of cancer. EMF Therapeutics Inc (Chattanooga TN, USA) has developed a new approach to cancer therapy based on the application of a therapeutic electromagnetic field (TEMF) to inhibit angiogenesis in growing tumors.

MATERIALS AND METHODS

This study is designed to investigate the potential of the pulsating magnetic field to reduce angiogenesis in an animal model. Female C3H/HeJ mice, 6 weeks old, were used in the study. Tumors (murine 16/C mammary adenocarcinoma) were induced via a single subcutaneous injection and were allowed to grow for 7 days to an average size of 100 mg before treatment started. A therapeutic electromagnetic field (TEMF) system having a proprietary signal designed by EMF Therapeutics, Inc. (Chattanooga, TN) was used. A 120 Hz pulsating magnetic field of 4mT and 5 mT was applied in this study. After 11 consecutive sessions of 10 min/day exposure to the magnetic field, the animals were sacrificed and an immunohistochemistry analysis of the tumors was performed.

RESULTS AND DISCUSSION

The effects were evaluated by the expression of CD31. The percentage of CD31 staining represents the percentage of endothelial cells in the analyzed sample. CD31 staining indicates that both magnetic fields statistically significantly ($p<0.05$) reduced the vasculature in the tumors: 39% at 4 mT magnetic flux density and 53% at 5 mT. The diminished percentage of CD31 staining is an indication for a reduction in the number of blood vessels in the tumor area. It appears that this is a good indication that the exposure of the animals to pulsating magnetic fields (10 min/day, 11 days) leads to a significant reduction in the tumor vasculature at both exposure conditions. The results apparently suggest that magnetic field effects are stronger when a 5 mT magnetic field is applied. Further studies are in progress to optimize the parameters of this physical factor.