



P18:101

New hyperthermic treatment with magnetic materials for metastatic bone tumors

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Background

Patients with bone metastasis in the extremities sometimes require surgical intervention to prevent deterioration of quality of life due to a pathological fracture. We have developed a new hyperthermic treatment modality using magnetic materials. The purpose of this study is to show the results of new hyperthermia for metastatic bone tumors.

Methods

This new hyperthermic treatment modality was applied for 25 patients with 27 metastatic bone lesions. The age of the patients ranged from 27 to 80 years of age (median, 63 years), and the follow-up period ranged from 3 to 63 months (median, 11 months). The primary lesions included 5 lung cancers, 4 renal cell carcinomas, 3 hepatocellular carcinomas, sarcomas and breast cancer and others. Regarding the operation sites, 11 were the femur, 10 the humerus, 5 the tibia and 1 the fibula. In 10 lesions, after curettage of the metastatic lesion, calcium phosphate cement containing powdery Fe₃O₄ was implanted into the cavity. For the 17 lesions, metal intramedullary nails were inserted into the affected bone. Hyperthermic treatment was performed postoperatively on days 8, 10, 12, 15, 17, 19, 22, 24, 26 and 29, using the newly developed electromagnetic field generator. The exposure time was 15 minutes per day. The radiographic outcome was evaluated at 3 months after surgery. The radiographic outcome was assessed according to following criteria. "Excellent" means a reduction of the lesion with visible bone formation. "Good" means no progression of the lesion for more than three months. "Poor" means a progression of the lesion. To evaluate the effectiveness of hyperthermia on radiographic findings, a univariate analysis was performed using the Mann-Whitney U test for non-parametric data.

Results

On radiographs, 10 lesions (37%) showed an excellent outcome, while 16 lesions (59%) showed a good outcome and one lesion (4%) showed a poor outcome. No serious adverse effects were observed during the follow-up period.

Conclusions

Our novel clinical hyperthermia modality using magnetic materials was thus found to achieve a good local control of metastatic bone lesions. Further investigations are needed before this technique can be employed as a standard therapy for metastatic bone tumors.

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