Oncological and non-oncological applications of electromagnetic hyperthermia (Oncothermia®) in the veterinary clinics – 2 years of experience

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Introduction

Loco-regional hyperthermia in oncology has ambivalence discretion in the medical community. The extremely long history of the method as well as the supposed universal ability to complement the existing traditional methods is not enough to prove its efficacy. The central point of the non-universal acceptance and the mixed feelings is the same time unsuccessful selective heat-delivery into the deep-seated tumors. The selectivity could be enhanced by electric field. Theoretical considerations showed the problem of the temperature dose-concept, and it is shown, that the thermal energy does not limit the electromagnetic effects through the membranes. Advantages of thermal and induced non-thermal effects of electromagnetic hyperthermia (SHI, Oncothermia®) in human medicine is in use for decades. Surprisingly there are much less references about the veterinary utilities.

Our objective was to check the clinical utility of electromagnetic hyperthermia as a single modality and in combinations in veterinary patients.

Materials and Methods

Dogs and cats affected by either primary or recurrent neoplasia referred to the National "F.J.C." Research Institute for Radiobiology and Radiohygiene (NIRR) from April 2006 to June 2010, were included. Initial work-up consisted of a physical examination, hematology and serum biochemical profile. The diagnosis was confirmed, if not properly performed before referral, through a core biopsy or a radiological evaluation of the lesion and, if enlarged, of the regional lymph nodes. Eligibility criteria included the following: non-resectable, non-metastatic tumors (measured by digital caliper, x-ray, ultrasonography, or scintigraphy, or CT, or PET/CT) and the surviving expectation of at least 6 months, no other antitumoral or corticosteroid or non-steroidal antiinflammatory treatments or surgery within 2 weeks prior to the primary tumor, with or without metastases to the regional lymph nodes, and without macroscopically evident (x-ray, or ultrasound, or scintigraphy, or CT and/or PET/CT) distant metastases and/or other life-threatening metastatic diseases. We applied SHI with capacitive coupled modulated 13.56 MHz sub-frequency method (Oncothermia®). OT was provided for different canine and feline oncological patients (ultrasound more than 64 cases) as a single treatment (994), and in a combination with fractionated Cobalt irradiation (51954) or with medical treatments (7758). Dog patients suffering from chronic diseases (4 osteosarcomas, 9 heart insufficiencies, 2 epilepsies, 2 non-healing ulcerations) were also co-treated with local (or regional) OT so that the original, non-edical treatments were not changed.

Results

Single OT in oncological diseases resulted significant tumor size decrease in 2 out of 6 cases, 3 stable disease and 1 progression of disease. Cobalt irradiation followed) by OT resulted 551 tumor-free status, 4251 partial remissions, 3951 stable disease, and progression of disease in 1 case. Chemotherapy boosted with OT resulted 27 partial remission, 37 stable disease, and 27 progression of disease in late stage, metastatic cases. Side effects: eg. asthenia (2 case), neocarcinoma (2 cases) occurred at the learning phase of technique, later on we could prevent this side effects with the constant superficial and deep temperature control in or patients. OT proved to be useful in all the non-oncological diseases and no side effects, contraindications were remarked.

Summary results of treatments


In other non-oncological chronic diseases (4 osteosarcomas, 9 heart insufficiencies, 2 epilepsies, 2 non-healing ulcerations) one-time orthopedic treatments showed improvement in clinical symptoms on the base of owner's and handling veterinarian's observations.

Case I. a complete response

Animal: name: Panda race: mixed sex: spayed female age: 9 years
Before treatment: Epilepticized fully conscious with multiple abscesses
Treatment: 6 a 30 minutes local oncothermia followed by immediate 0.5 Gray Cobalt irradiation

After treatment: No visible improvement of convulsions, 3800 minutes later, no convulsions

Case II. a complete response

Animal: name: Tony race: mixed sex: male color: yellow age: 7 years
Before treatment: Hypermobility Grade III in the elbow region
Treatment: 2x20 min. in diameter/large primary skin tumor

After treatment: No enchapitements tumor mass only mild side effects of non controlled drug administered.

Case III. a partial response

Animal: name: Ruli race: mixed sex: female color: brown age: 8 years
Before treatment: Gangrenous Toronto with multiple abscesses
Treatment: 6 a 60 minutes local oncothermia followed by immediate 0.5 Gray Cobalt irradiation

After treatment: Complete recovery (no relapse of treatment volume has been detected after completing the therapy. The dog is walking, no tumors found, 3 months after completing the therapy

Case IV. a non-responding patient

Animal: name: Angel race: mixed sex: spayed female color: brown age: 9 years
Before treatment: Chronic carcinoma merged with abscesses in lymph nodes

Treatment: 6 a 30 minutes local oncothermia followed by immediate 0.5 Gray Cobalt irradiation

After treatment: Primary tumor is a 2 cm 3 cm basocarcinogenic sarcoma with multiple abdominal metastases

Conclusion

We concluded that local and regional OT could be a useful tool as a single antitumoral modality but even more clinical utilities could be reached in a combination with radiosurgery or with chemotherapy, OT could be advantageous in the treatment of a variety other chronic diseases too. Further pro- and retrospective clinical studies needed to implement this novel technique into veterinary medicine.

References