

STATIC MAGNETIC FIELDS IN THE TREATMENT OF WOUNDS AFTER RESECTION OF ADENOCARCINOMA MAMMAE IN THE DOG

Jarosław Pasek^{1*}, Grzegorz Cieślak¹, Tomasz Pasek², Damian Kotela³ and Aleksander Sieroń¹

1. Medical University of Silesia Chair and Clinical Ward of Internal Diseases, Angiology, and Physical Medicine; Centre of Diagnostics and Laser Therapy in Bytom, of the Silesian Medical University in Katowice, Poland
Head of Clinic: Prof. dr hab. n. med. dr h.c. Aleksander Sieroń
2. Rehabilitation Unit of the St. Barbara Provincial Specialist Hospital No.5 in Sosnowiec
3. EUROVET Clinic Veterinary in Będzin Head of Clinic: lek. wet. Damian Kotela

Corresponding author: Jarosław Pasek

ABSTRACT: Lactiferous gland tumours are the most frequently occurring skin proliferative lesions in female dogs. Usually they are isolated single lesions, having hard and tumour-like structure. They may result in metastases to lungs and other internal organs, thus it is so important to diagnose them early and to initiate suitable surgical treatment. In most cases the post-operative course is without complications, with subsequent healing of surgical wounds. In some cases, however, the healing process gets complicated and calls for modification of pharmacological treatment, or introduction of other treatment methods, including therapy by means of magnetic fields which promotes intensification of healing chronic and complicated wounds. In the study the authors present the promising results of treatment of infection complications in healing of surgical wounds in a bitch after excision of lactiferous gland adenocarcinoma, to whom therapy with steady magnetic field was applied.

Keywords: adenocarcinoma, physical medicine, static magnetic field, treatment

INTRODUCTION

Tumours are the most frequently occurring skin proliferative lesions in animals. Their frequency of occurrence is assessed at about 30%. Early diagnosis of those lesions results in highly probable efficient treatment. Unfortunately, the misleadingly not dangerous appearance of some lesions, as well as their slow development result in incurable complications, and in consequence the death of animals, due to too late introduction of treatment (Saba, 2011; Massari, 2011).

Lactiferous gland tumours constitute the most frequently occurring skin proliferative lesions in female dogs, So far, the direct cause of their occurrence has not been established so far (Bennetti and Biggar, 2011). Adenocarcinoma is the most frequently occurring malignant tumour of lactiferous glands (Saba, 2011). Despite being frequently diagnosed, it still remains one of the most dangerous neoplasms, while its treatment may be successful only in case of early diagnosis and positive result of surgical treatment. Most often, the owner of the dog visits the vet worried about the occurrence of a nodule, small or bigger, on the dog's belly or chest. Those nodules are directly connected with lactiferous gland and may take a form of small, hard balls, infiltrating the entire abdomen area. The skin covering such nodule may remain unchanged, yet there are cases where the neoplastic infiltration comprises skin, together with subcutaneous tissue. In case of advanced lesions inside the tumour, necrotic lesions occur and fistulae get

formed, through which pus or blood ooze. The skin around the tumour may be ulcerated and changed due to inflammation. Other possible manifestations include lymphadenopathy, oedemas, or lameness. Most dogs with such diagnosis die within the first year after surgery. When metastases occur, mortality rate reaches 80% (Saba, 2011; Hojo, 2011).

In case of diagnosing adenocarcinoma of mammary ridge, the treatment of choice is surgery, consisting of excision of the tumour with a margin of healthy tissue and lymphatic nodes, in which the metastatic neoplastic cells are often located. Before the procedure, the doctor may perform a biopsy of the tumour or lymphatic node, in order to ascertain whether the tumour is malicious or not, as well as chest x-ray to check for the presence of possible metastases (Bennetti and Biggar, 2011; Gelb, 2010).

Many years of experimental and clinic studies proved that living organisms, in the course of evolution, had been continuously exposed to electromagnetic fields (Sieroń, 2002; Opalko, 2009). The present state of knowledge makes it doubtless that the Earth magnetic field exerts direct influence upon living organisms. Moreover, every living organism is capable of generating its own magnetic field, which it uses for auto-regulation of its metabolic processes, as well as for provision of correct homeostasis. That is why in contemporary medicine physical methods are used, which utilize pulsed magnetic fields, alternating, as well as constant magnetic fields for treatment, prevention, and rehabilitation in numerous diseases. Such treatment comprises not only the diseases related to lesions within motor organs (degenerative and inflammatory lesions), but also diseases affecting soft tissues (e.g. wounds of different origin that are hard to heal, keloids, scalds, bedsores, or trophic lesions) (Sieroń, 2002; Pasek, 2007).

In the paper the authors present the results of wound treatment in a dog after surgical excision of adenocarcinoma, in which due to complications of skin healing treatment with static magnetic field was applied. Static magnetic field is a physical factor, the source of which are elements having stable magnetic moment, called magnets. Such a field is characterized by the value of vector of magnetic induction B, its spatial distribution, and polarization. Applied locally for 45 minutes every day, for the period of 20-25 days, it has beneficial effect in case of numerous ailments and conditions related to diseases having degenerative or inflammatory background, or connected with lesions within soft tissues (Janicki, 2008; Pasek, 2010).

Case description

A female Boston terrier (4 years of age) was brought to veterinary outpatient clinic due to a lesion located within right mammary ridge. The X-ray that was taken did not reveal pathological lesions. The bitch underwent mastectomy procedure. During the surgical procedure, performed under general anaesthesia, the right mammary ridge was excised, together with a substantial margin of healthy tissue and adjacent lymphatic glands. The disintegrating neoplastic tumour occupied a substantial part of the gland.

The histopathological examination performed revealed: "*Neoplastic proliferation of adenocarcinoma mammae type, having average mitotic index, with vast necrotic areas and inflammatory infiltrations*".

The dog's convalescence after the surgery was uneventful. The female dog was administered pharmaceuticals.

By licking the surgical wounds, the bitch caused their infection and disturbance of the uneventful healing process. The follow-up and treatment used so far failed to bring satisfactory results. Fistulae began to form around the wounds, which began to produce purulent secretion, tinted with blood and mucus. The skin around the tumour was swollen, painful, and with inflammatory lesions (Fig. 1).

Because of the above manifestations, a decision was taken to apply physical treatment to that dog, using for that purpose an applicator (mattress) for therapy with the use of static magnetic field.



Figure 1. The local state after surgical operation (the photo executed before the start of the therapy with static magnetic fields)

Physical treatment

In physical treatment, an applicator (mattress) for therapy with the use of static magnetic field Energy For Life (EFL) was used (by Perfect Harmony, Poland) (Fig. 2). That applicator uses suitably polarized neodymium-iron-boron ($Nd_2Fe_{14}B$) magnets, with extremely high energy density (about $270kJ/m^3$). The method used in the procedure was that the dog, while staying at home (ambulatory treatment) spent unlimited amount of time on the mattress, for the period of 6 weeks.



Figure 2. The large applicator (maternal) for static magnetic field therapy

RESULTS AND DISCUSSION

In the course of therapy with static magnetic field, the surgical wound - despite infection-related complications after the procedure – quickly healed in a proper way. After merely a few days the purulent discharge diminished, and the swelling became less prominent. The lesion got reduced by half after three weeks,. Moreover, after a few weeks of use of the applicator generating constant magnetic field, one could notice steady improvement in physical activity, manifested in enhanced agility and better appetite.

Application of static magnetic fields accelerated the process of necrotic tissue removal from wounds, a quicker eradication of purulent foci occurred, as well as inhibition of development of bacterial microflora in the wound. Gradually, also the excretion of serous contents from the wound got reduced, and the continuing inflammatory

process slowed down. Complete healing of wounds took place after 6 weeks of therapy. The final result of treatment is present on Figure 3.



Figure 3. The local state after the end of therapy with use of static magnetic field (six weeks)

At present (half a year after the surgery) the animal feels well indeed. The belly got covered with hair and one can hardly notice the traces of the surgery. No keloids were formed in the area of the healed wounds.

Discussion of results

Pharmacological treatment (chemotherapy) in case of mammary ridge neoplasms in dogs usually is not effective. Radiotherapy does not improve survival rate of ill animals, either. The only chance in tumour excision, before metastases are diagnosed into other regions of the body (De Froge and Colmery, 2000; Balka , 2011).

Unfortunately, due to the substantial mobility of animals that are subject of treatment, surgical wound healing complications are frequent, in the form of infections. The positive results obtained concerning treatment of surgical wound healing complications indicate the potential possibility of using non-pharmacological methods in treatment of chronic hard-to-heal wounds, which stimulate the organism by means of a specific kind of physical energy, magnetic energy in the case presented. In order to elicit the stimulation effect, a specific threshold value is required of the energy of external magnetic field is required, to compensate for the kinetic energy of components of the reaction (Sieroń , 2002; Janicki and Janicki, 2008).

Healthy tissues may be generated and may function correctly only under the influence of electromagnetic fields having suitable activity, while to maintain homeostasis and to regulate the proper course of metabolic processes, living organisms use not only their own electromagnetic fields, but also the influence of external magnetic fields (Janicki and Janicki, 2008; Yamaguchi, 2011). Magnetic fields affect the ions that move in the organism, by means of Lorentz force, directed perpendicularly to the stream of ions and the direction of magnetic field force lines, causing the phenomenon of deflection of the trajectories of negative and positive ions, in opposite directions. Moreover, in constant magnetic field ions accumulate on biological barriers, e.g. on cell membranes, which leads to ionic polarization, and change of the ion diffusion rate between the inside of the cell and the extracellular space. A consequence of the phenomena mentioned is a change in the intracellular concentration of ions of calcium, sodium, and potassium, among others, which has substantial influence upon the intensity of numerous metabolic processes, and the wound healing rate (Pasek , 2010; Janicki and Janicki, 2008; Adey, 2004). Considering the biological mechanisms of the influence of static magnetic fields, one should underline that the application of a physical medicine method provides entirely new possibilities treatment possibilities (Yamaguchi, 2011; Jing , 2010). However, confirmation of the results obtained requires studying a larger representative study group. Only in such a way will that therapy be able to take the place it deserves among the available methods of treatment.

Conclusions

1. Therapy using static magnetic fields results in complete healing of wounds after laciferous gland adenocarcinoma excision surgery in dogs.

In the planning of complex postoperative management, taking into account physical medicine procedures is of considerable importance

REFERENCES

- Adey WR. 2004. Potential therapeutic application of non-thermal electromagnetic fields: ensemble organization of cells in tissue as a factor in biological field sensing. *Bioelectromagnetic medicine* 8(5):1-5.
- Balka G, Szabó L and Jakab C. 2011. First report of an endometrial adenoacanthoma in a dog. *Acta Vet Hung* 59(2): 225-229.
- Bennetti IC and Biggar MA. 2011. A triangular advancement technique to avoid the dog-ear deformity following mastectomy in large breasted women. *Ann R Coll Surg Engl* 93(7): 554-559.
- De Froge DH and Colmery BH. 2000. *An Atlas of Veterinary Dental Radiology. Complete with a Glossary of Veterinary Dental Terminology.* Iowa State University Press.
- Gelb HR, Freeman LJ, Roghleder JJ and Synder PW. 2010. Feasibility of contrast-enhanced ultrasound-guided biopsy of sentinel lymph nodes in dogs. *Vet Radiol Ultrasound* 52(6): 628-632.
- Hojo Y, Tsuchiya T, Shiraki A, Suzuki K, Shibutani M and Mitsumori K. 2011. High-Grade Myofibroblastic Sarcoma of Inguinal Region in a Dog. *J Vet Med Sci* 9: 1-5.
- Janicki JS. 2008. The use of static magnetic fields in therapy. Instytut Badań Fizykomedycznych. Poznań.
- Janicki JS and Janicki ŁJ. 2008. The influence of gradient magnetic fields on human organism. *Acta Bio-Optica et Informatica Medica* 4(14): 300-303.
- Jing D, Shen G and Cai J. 2010. Effects of 180mT static magnetic fields on diabetic wound healing in rats. *Bioelectromagnetics*. 31(8): 640-647.
- Massari F, Nicolì S, Romanelli G, Buracco P and Zini E. 2011. Adrenalectomy in dogs with adrenal gland tumors: 52 cases (2002-2008). *J Am Vet Med Assoc* 239(2): 216-220.
- Opalko K. 2009. The treatment of electromagnetic fields. Wydawnictwo MedPharm Polska. Wrocław.
- Pasek J, Cieślak G., Budziosz J, Pasek T and Sieroń A. 2010. Static magnetic field in physical medicine” in: J. Taradaj, A. Sieroń, M. Jarzębski, “Practical physics therapy”, ELAMED, Katowice.
- Pasek J, Pasek T and Sieroń A. 2007. Some practical recommendation in use of magnetic fields and light in physical medicine. *Acta Bio-Opt Inform Med* 13: 285-289.
- Saba C, Ellis A and Cornell K. 2011. Hypocalcemia following surgical treatment of metastatic anal sac adenocarcinoma in a dog. *J Am Anim Hosp Assoc* 47(6): 173-176.
- Sieroń A, Cieślak G and Kawczyk-Krupka A. . 2002. The use of magnetic fields in medicine. Wydanie II. α – medica press. Bielsko – Biała.
- Yamaguchi-Sekino S, Sekino M and Ueno S. 2011. Biological effects of electromagnetic fields and recently updated safety guidelines for strong static magnetic fields. *Magn Reson Med Sci* 10(1): 1-10.