CLINICAL AND PARACLINICAL EVALUATION OF THE EFFECT OF ACUPUNCTURE ON A RABBIT AND DOMESTIC CARNIVORES

SUMMARY OF PhD THESIS

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SUMMARY

Acupuncture is a medical microtraumatic method of stimulating tissue carried out by needles. The existence of acupuncture in the medical field can offer the unique character of a recognized technique. With its origins in the ancient Orient, acupuncture is now conducted using two essential approaches: “Traditional Chinese Medicine” or “Eastern acupuncture”, and “Modern acupuncture” or “Western acupuncture”. Both approaches are used for different diagnoses and treatments in the veterinary field. Electroacupuncture is an electrical stimulation method commonly used in both.

In acupuncture, the neurohormonal theory considers the peripheric nervous structures to be essential in the mechanism of action with a direct influence on the hypothalamus-pituitary-adrenal axis (Gabriel et al., 2003). The effect of the study and mechanism of action in acupuncture is at the core of a strong debate in the medical field. Hormonal and non-hormonal paraclinical methods which are expedite, multiple and integrated in acupuncture research can bring forward new information. The compulsory need to use these tests in research can open up a thorough study of acupuncture in the modern sphere in support of practice medicine.

By using acupuncture treatments in small animal therapy with an associative nature in drug medication, there is ample opportunity for the practitioner to use acupuncture successfully and with minimal side effects.

The studies included in this thesis were completed between 2010 and 2014 and their main objective was to study surgical electroacupuncture analgesia and laboratory changes, ASTRUP determination in the experimental electroacupuncture study, thermal changes in bipolar electroacupuncture, the influence of electroacupuncture on the soft tissue healing process, and the use of acupuncture in the treatment of some disorders in dogs and cats.

This thesis is structured in two parts. The first part is entitled “State of the Art” and comprises 29 pages and the second part is entitled “Personal Contributions” and contains 109 pages. This study includes 103 figures and 16 tables.

The first part of thesis, Chapter I, is entitled “State of the Art” and it summarizes the current state of knowledge and extends over 5 sections.

The first chapter describes the history of veterinary acupuncture.

In the second chapter, the basics of veterinary acupuncture are discussed including actual elements and principles, a description of acupuncture needles and electroacupuncture, the neurohormonal mechanism, acupuncture treatment and the concept of “trigger points” in muscular disorders.

The third chapter presents surgical acupuncture analgesia and an evaluation.

The fourth chapter includes general aspects of the wound healing of soft tissues (skin and muscle) by using experimental electroacupuncture research.

The fifth chapter discusses new information about types of surgical procedures conducted under surgical acupuncture analgesia, the influence of electroacupuncture on the organism, electroacupuncture in tissue healing, and pathological conditions in animals which can be treated with acupuncture.

The second part of the thesis contains a personal contribution detailed in six chapters. The structure of each chapter includes the objectives and the materials and methods used in the experimental study on the effect of acupuncture or electroacupuncture on animal organisms. Presentation of the experimental part is
followed by an assertion of general conclusions, recommendations, and literature cited. In the present study 195 references were cited.

**Chapter II** is entitled “Electroacupuncture Analgesia in a Rabbit Ovariohysterectomy” and it provides a study research of a surgical electroacupuncture analgesia model carried out on a rabbit undergoing an ovariohysterectomy which is then compared to analgesic drugs used in a control group.

**Materials and Methods**

The research was conducted on 12 New Zealand white rabbits (*Oryctolagus cuniculus*). The animals underwent an ovariohysterectomy operation under neuroleptanalgesia (NLA) and surgical electroacupuncture analgesia (EAA). Animal restraint was used with a specially designed device for this experiment. The animals were divided into 2 groups represented by the control group of 5 rabbits (NLA) and the test group represented by 7 rabbits (EAA). A clinical assessment of analgesia was performed in the preoperative, operative and postoperative stages. Surgical electroacupuncture analgesia in a rabbit includes acupoints and the electroanalgesic technique newly established for this research with drug-free analgesics. Two electroacupuncture devices (WQ-IOD1 and KWD-808 1) were used in order to provide local stimulation at the incision and paravertebral stimulation to enhance systemic analgesia. The aim in using the control group under NLA consisting of Xylasine and Ketamine was to underline the comparative features represented by vital signs, analgesic degree and postoperative recovery time.

**Results and Discussion**

In the EAA group, induction time was depicted and the changes in vital signs were expressed by tachypnea, bradycardia and normal body temperature, while the NLA group in the preoperative stage expressed all vital parameters as normal with an initial peak of tachypnea.

During the operative phase, the level of local analgesia at the incision site and the addressing of the internal organs involved in the ovariohysterectomy under electroacupuncture analgesia were established. The success of analgesia is compulsory when performing this type of surgical procedure on a rabbit. NLA has proven to be a good method of general anesthesia when performing this type of surgery.

In the postoperative period, the evaluation recorded in the EEA group indicated good local analgesia at the incision site and a short postoperative recovery time, important elements that were not observed in the NLA group.

EAA in abdominal surgery (local and segmental method) can provide for the practice a valid analgesic method with free-drug components which is an important section for the anesthesiology.

**Partial Conclusions**

EAA in a rabbit ovariohysterectomy provides adequate surgical analgesia and in the postoperative period with a shorter recovery time.

NLA in a rabbit ovariohysterectomy ensures good surgical analgesia followed by poor local analgesia and a prolonged postoperative recovery time.

The restraining device “Acupar”, designed by the author, is suitable when conducting an ovariohysterectomy on a rabbit.
Chapter III, entitled “Paraclinical Investigations in a Rabbit Ovariohysterectomy”, describes an experimental model for the evaluation of glycemia, serum cortisol and ACTH recorded in three different sections of the research and using two models of general anesthetics as procedures required for the operation.

Materials and Methods
The research was conducted on 10 New Zealand white rabbits (*Oryctolagus cuniculus*) divided into 2 groups: the NLA group consisted of 3 rabbits and the EAA group had 7 rabbits. Blood sampling was carried out during the preoperative, operative (the approach of the 2nd ovary) and postoperative (1 hour after surgery) periods. Two EA devices (WQ-IOD1 and KWD-808 1) were used in order to provide local and paravertebral stimulation.

The laboratory determinations were completed by using an electrochemiluminescence immunoassay technique (ECL IA) for cortisol (nmol/l), an enzyme-linked immunosorbent assay chemiluminescence detection technique (ELISA) for ACTH (pg/ml), and for glycemia (mmol/l) a glucometer (One Touch Verio Pro) was used with test strips.

Results and Discussion
The initial laboratory values determined during the preoperative stage for both the NLA and EAA groups in a rabbit ovariohysterectomy were considered to be the start values in the statistical paraclinical evaluation and determination (Table 1).

### Table 1

<table>
<thead>
<tr>
<th>Rabbit Ovariohysterectomy</th>
<th>GLYCEMIA (mmol/l)</th>
<th>CORTISOL (nmol/l)</th>
<th>ACTH (pg/mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NLA group</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I - 6.96</td>
<td>1 - 93.4</td>
<td>1 - 6.4</td>
<td></td>
</tr>
<tr>
<td>O - 11.8</td>
<td>+ 0.69*</td>
<td>O - 123.1</td>
<td>+ 0.31↑</td>
</tr>
<tr>
<td>PO - 17.3</td>
<td>+ 1.48↑</td>
<td>PO - 156.6</td>
<td>+ 0.67↑</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PO - 10.56</td>
<td>+ 0.65↑</td>
</tr>
<tr>
<td><strong>EAA group</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I - 6.2</td>
<td>1 - 72.9</td>
<td>1 - 7.2</td>
<td></td>
</tr>
<tr>
<td>O - 10.5</td>
<td>+ 0.69↑</td>
<td>O - 265.04</td>
<td>+ 2.63↑</td>
</tr>
<tr>
<td>PO - 13.7</td>
<td>+ 1.20↑</td>
<td>PO - 192.6</td>
<td>+ 1.64↑</td>
</tr>
</tbody>
</table>

Legend:
- 1* – the initial mean of the group
- + 0.69* – the increase with 0.69 times from the initial mean of the case
- ↑ – the increase from the initial mean of the group

The results recorded in the operative stage reflect an increase in both groups with a maximum value for the EEA group. The increases explain a direct involvement of the hypothalamus-pituitary-adrenal (HHA) axis in the systemic analgesic mechanism initiated by a sympathetic autonomic response to stressors. Surgical EAA is a result of stress analgesia. NLA determines a neurovegetative disconnection (Oana et al., 2011) where the activity of the HHA axis was stimulated. Postoperative laboratory values reflect a different graphic between the groups. In the EAA group, complete suppression of the presence of ACTH (+ 0.027↑) was recorded and an ascendant graphic for cortisol and glycemia with decreased values.
The NLA group recorded high values for glycemia and cortisol while the values of ACTH were lowered but at a high level compared with the initial results. The activity of the HHA expressed by the increased values for glycemia, cortisol and ACTH reveals a high level of stress as an effect of intact perception to feeling pain which was triggered by the surgery. Local assessment at the incision site in the EAA group confirms the presence of analgesia while in the NLA group the sensitivity of tissue was present. The association of clinical information with the assessment of glycemia, serum cortisol and ACTH bring positive elements when evaluating the analgesia.

Partial Conclusions

EAA and NLA determine the activation HHA complex in response to external factors representing a crucial segment in the mechanism of stress.

Chapter IV, entitled “Influence of Electroacupuncture on Some Blood Parameters Determined by ASTRUP”, analyzes a model for the evaluation of blood parameters in electroacupuncture in rabbits by the ASTRUP method. The ASTRUP method evaluates 16 parameters including acid-base balance, Na$^+$, K$^+$ and Ca$^{2+}$, glycemia, lactate and haemoglobin.

Materials and Methods

The research was conducted on 6 New Zealand white rabbits (*Oryctolagus cuniculus*). Restraint, acupuncture formula and electroacupuncture technique are novelty elements. Two EA devices (WQ-IOD1 and KWD-808 1) were used in order to provide a local stimulation of the abdomen and paravertebral.

The working method consists of collecting blood samples at 3 different times: initially, during electroacupuncture (EA), and post-EA (1 hour after EA stimulation). Blood samples were analyzed using the ASTRUP method.

Results and Discussion

The use of the ASTRUP method in the experimental study of the influence of electroacupuncture in a rabbit demonstrates changes with respect to acid-base balance and some elements such as Na$^+$, K$^+$ and Ca$^{2+}$. The ASTRUP method is normally used as a means of diagnosis in emergency and surgery, when evaluating intensive care cases and in experimental modules (Severinghaus et al., 1998). In EA, a blood panel was recorded with different changes represented by a decrease of pH and O$_2$ concentration and increases in bicarbonate, lactate, Na$^+$, K$^+$, Ca$^{2+}$ and glycemia. One hour after EA stimulation, small value changes were noticed with regard to lowering blood glucose and the lactate associated with an ascendant trend for bicarbonate, CO$_2$, Na$^+$, K$^+$ and Ca$^{2+}$.

The compensatory base curve reflects the effort of the body after the acidosis to restore the acid-base balance. Elevated presence of Na+, K+ and Ca2+ in the normal range demonstrates increased cell activity. Initiated muscle contractions induce glycolysis and increase lactate as an energy source for support. Glucose as a precursor in providing energy in ion transfer between cellular spaces, vasoactive changes, muscle contraction, increased metabolic and cardiorespiratory activity, had minor variations during the observations. In addition to glucose, the required high O$_2$ is induced as a result of muscle contraction, the processes marked as vasoactive and cardiorespiratory. The concentration of CO$_2$ was high due to the increased catabolic processes.
Partial Conclusions

The ASTRUP evaluation in rabbits is a versatile and efficient method of assessment which has confirmed the changes reflected in acid-base balance, glucose, lactate, O\textsubscript{2} and CO\textsubscript{2} concentration and elements such as Na\textsuperscript{+}, K\textsuperscript{+} and Ca\textsuperscript{2+} directly involved in the mechanism of EA.

Chapter V, entitled “Investigation of the Influence of Electroacupuncture on Thermal Changes in a Soft Tissue Defect”, analyzes a model for the evaluation of thermal changes in the soft tissues of the experimental defects in a rabbit caused by bipolar EA.

Materials and Methods

The research was conducted on 5 New Zealand white rabbits (Oryctolagus cuniculus). General anesthesia was provided by neuroleptanalgesia (Ketamine 50 mg/kg im + Xylasine 5 mg/kg im) when carrying out the defects on the paravertebral tissue of the body. Tissue defects were stimulated for 20 minutes with an EA device (AWQ-104E T.E.N.S., 80 Hz / 2.0 V) with reversed polarity after 10 minutes. During the study, the temperature was measured with an infrared thermometer (DT-8806C) at the place of the acupuncture insertions and tissue defects and the internal temperature was monitored by a Drager device – Infinity Delta.

Results and Discussion

Vasoactive changes in the soft tissues caused by EA stimulation directly influence local temperature. Thermal changes in acupuncture are determined by vasodilatation as a result of changes in autonomic tone resulting from segmental reflex (Kendall, 1989; Omura, 1975). The initial EA stimulus differentiates tissue temperature at the needle’s insertion (negative and positive poles) which was correlated with a decreased local temperature as a result of local vasoconstriction at the negative pole and the tissue defects. At the positive pole, increased temperature was recorded as a result of local vasodilatation. Internal thermography showed a decrease in body temperature of 0.1°C every 2 minutes which is a side effect of general anesthesia. Further accommodation of tissues to EA stimulus triggers vasodilatation at both poles and at the defects. Reverse polarity during the study did not change the local temperature. Bipolar EA influences the clinical perception differently at the place of local stimulation, being reduced at the positive pole and marked at the negative pole.

Partial Conclusions

Bipolar EA in an experimental study of soft tissue defects in a rabbit influences local temperature and clinical perceptions that act on the peripheral nervous system.

Chapter VI, entitled “Electroacupuncture Effect on the Soft Tissue Healing Process in a Rabbit”, includes a model for assessing the healing of soft tissue defects under the influence of bipolar EA stimulation.

Materials and Methods

The research was conducted on 10 New Zealand white rabbits (Oryctolagus cuniculus). The rabbits were separated into two groups: control and test. General anesthesia was provided by neuroleptanalgesia (Ketamine 50 mg/kg im + Xylasine 5 mg/kg im) when carrying out the defects on the paravertebral tissue of the body. Tissue
defects were stimulated for 20 minutes with an EA device (AWQ-104E T.E.N.S. 80 Hz / 2.0 V) with reversed polarity after 10 minutes. Every rabbit was assessed for cardiac and respiratory activity, and internal and skin temperature. Biopsy samples were collected on the 2nd, 4th and 6th days of EA stimulation under Halotane (3-4%). During the biopsy sampling, pathological changes were recorded. Biopsy samples were prepared and stained with Hematoxylin-Eosin (H&E) and Trichrome-Masson (T&M). Microscopic examination used a rating scale degree of 0 – 3.

Results and Discussion

Bipolar EA reduced the degree of inflammation in the inflammatory phase of the healing process. The proliferative degree was increased on day 4 and was mainly influenced as a consequence of reducing the inflammation recorded during the first days.

EA facilitates a reduction of mechanical stress tissue which had a positive effect on healing muscle defects.

An evaluation of skin thickness suggests an increase on days 2, 4 and 6 with superior results in the treated group compared to the control group.

Bipolar EA carried out on soft tissue defects in a rabbit does not promote side effects such as infection, bleeding or local tissue necrosis as a result of EA stimulation.

The use of acupuncture in medical therapy is mainly based on the analgesic and anti-inflammatory effects expressed when the tissue is stimulated (Allen, 1994; Gabriel et al., 2003).

EA influences vascular activity and promotes capillary vasodilatation responsible for the local blood increased intake with an important role in hemodynamic, mechanic (decompression), anti-inflammatory and immunity without side effects.

Partial Conclusions

Bipolar EA promotes the healing process through an anti-inflammatory effect, early proliferative and epithelial stimulatory in a rabbit.

Chapter VII, entitled “Acupuncture in Small Animal Therapy (Some Disorders)”, assesses the effect of acupuncture and electroacupuncture in the treatment of a number of conditions in dogs and cats.

Materials and Methods

Research was conducted on dogs and cats (31 cases) with various pathological conditions currently encountered in a small animal practice. The treatments were based on 4 types of needles (Natural, Ding Dragon, Tewa and Seirin) and 2 types of EA apparatus (WQ-IOD1 and KWD-808 1). Prior to treatment, the owners were informed about the acupuncture, the way of action, the methods of treatment, the reaction and the response of the animal. Their consent was then requested (verbal or signed). The treatment plan was designed for each case. The diagnosis was made according to the Western approach. The evaluation of the patients had two sections: reaction and response.

During the treatment session, the reaction of the pet to the acupuncture was evaluated. The evaluation of the effect of the treatment was based on the analysis of the observed changes mentioned by the owners and the results of a physical examination. The overall outcome of the treatment was assessed in grades: very good (80-100%), good (30-80%) or low (< 30%).
Results and Discussion

The acupuncture treatments involved 31 cases (28 dogs and 3 cats) with a number of pathological conditions including: musculoskeletal (26), articular (7), neurological (7), emergency (surgical respiratory syncope) (4), respiratory (3), digestive (1), renal (1), and dermatologic (1). Of these, 43 were treated by dry needling stimulation and 7 conditions were treated by using EA. 145 acupuncture sessions were completed using more than 2000 needles (4 brands) and 2 EA apparatus. From a total of 31 cases, 30 cases (96.8%) had a positive response and 1 case (3.2%) had a poor response. These results demonstrate that the number of animals which react during acupuncture is very high. Among the clinical changes signifying animal reaction the following were observed: increased respiratory rate (normal values), tachypnea, wet nose, ptosis, drowsiness, relaxation and restlessness.

Acupuncture and EA treatments performed on pets (dogs and cats) represent a significant proportion of practicing veterinary acupuncture which includes treatment of a wide range of pathological conditions such as musculoskeletal, articular, internal, skin and neurologic (Allen, 1994; Huiseng et al., 2007). Among these are the positive effects of acupuncture in cardiorespiratory syncope.

In this study, 4 of the 31 cases were evaluated as having a “poor response” to the treatment with either no improvement or the degree of improvement was inconsistent. In the 4 cases with a poor response, a clinical response to the acupuncture treatment was recorded. The evidence of a clinical reaction to the treatment of acupuncture is a positive sign but it is not necessarily followed by a treatment response.

The evaluation of the response to the treatment of dogs and cats by acupuncture in a group of 31 cases including 50 pathological conditions was expressed by a very good response with 50% in 25 conditions, a good response with 40% in 20 conditions, and a poor response with 10% in 5 conditions. Animal temperament and current pathological conditions contributed decisively to the success of the acupuncture treatment.

Performing acupuncture to treat musculoskeletal and joint disease has proved effective with an overall very good response of 48.5%, a good response with 45.5% and a poor response with only 6%. Positive results were recorded 2/4 weeks after starting treatment.

Treating trigger points in musculo-articular conditions by dry needling produced positive results.

Acupuncture treatment of neurological deficiencies could be an alternative treatment.

Respiratory resuscitation is easily performed using acupuncture with rapid effect with minimum physical effort by the surgeon.

Acupuncture induces anti-inflammatory, vasodilatory, antitussive, decongestant sympathetic, relaxing and immunomodulatory effect which is an option in the treatment of respiratory disorders.

Digestive, renal and dermatological disorders that are common in pets can be integrated into the treatment protocol with acupuncture, often with positive results.

Performing acupuncture on the same day as immunoprophylactic vaccination should be avoided.

A combination treatment with long-term medication for some conditions in dogs and cats (Cushing’s disease, hyperthyroidism, heart disease) did not affect the therapeutic effect of acupuncture.
Partial Conclusions

Acupuncture is a method of treating some musculoskeletal, joint and skin disorders in dogs and cats and respiratory syncope in dogs.

Limiting stress factors enhances the positive effects of acupuncture.

Acupuncture may be associated with the medication for heart disease, thyroid or endocrine glands (Cushing’s disease and hyperthyroidism) and dog vaccination should be avoided during this treatment.
References