Assessment of Pain Submission in Dogs Submitted to Dorsal Acetabular Denervation

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ABSTRACT

Background: Hip dysplasia is a disease characterized by laxity of the joint and subsequent development of osteoarthritis. Pain is initially caused by joint looseness and instability. Dorsal acetabular denervation surgery have been used with an analgesic objective. The technique initially proposed was modified, by performing a larger area of denervation. There are no studies referring to the pain parameters accepted by researchers regarding the assessment of this technique are available in the literature. The aim of this research was express by cortisol and serum glycemia levels, the remission of pain in the patients submitted to acetabular denervation.

Materials, Methods & Results: The serum levels of cortisol and glycemia were analyzed in 11 dogs with hip dysplasia at moments 0 (M0), I (M1), II (M2) and III (M3), which were respectively the moment of the diagnosis, 2, 7 and 15 days after the surgical procedure. All the patients were submitted to the surgical intervention called dorsal acetabular denervation. The colorimetric enzymatic method was used for glucose measurement and the reading was performed using a spectrum photometer. For the serum measurement of cortisol the ELISA method was used. The statistical analyses were processed with the help of a computerized statistical program (Minitab Release 13). The final data obtained were analyzed regarding their parametric distribution using the Kolmogorov-Smirnov test. The analyzed data presented a parametric distribution and had means compared by the Tukey’s analysis of variance. Differences with P values equal or smaller than 0.05 were considered significant. The correlation between the glycemia and serum cortisol values was evaluated by the Pearson test. The statistical analysis of the results points out a significant difference regarding the cortisol levels (μg/dL) at moments M1 and M2 regarding the moment M0, and at moment M3 regarding the other moments. There was no significant statistical difference for the analyzed moments regarding the glycemia (mg/dL) of the patients. There was a low correlation between the serum glycemia and cortisol levels when compared by the Pearson correlation test.

Discussion: The denervation of the coxofemoral joint capsule has demonstrated satisfying clinical effects. However, the evaluations presented are subjective, demonstrating only the indications of questionnaires and physical examinations, not evaluating the cessation of the algescic state presented by these patients in a qualitative and quantitative manner, like we did in this research. The pain can be considered a stress factor and hence results in a neuroendocrine response due to the stimulus of the hypothalamus-hypophysis-adrenals axis leading to an increase in the plasmatic levels of cortisol. The reason why the measurement of cortisol is an excellent parameter for the assessment of the neuroendocrine modulation of pain. In the present study, it was possible to demonstrate the lowering of the serum levels of cortisol at moment M1 regarding the M0, and the same fact was repeated at moment M2. The repetition of the difference at the M3, with no use of any analgesic agents, shows the efficacy of the procedure. The results pointed out corroborate the ones described by others researchers, in which in 7 days after the surgical intervention, owners reported that the animal presented good or very good quality of life in 51% of the evaluated cases. Animals presenting better quality of life, with no apparent pain demonstrate which is also satisfying to their owners who, in all cases, reported a decrease in their personal suffering that they experienced while watching their animals suffer. The modified dorsal acetabular denervation technique was effective in reducing pain in eleven dogs with hip dysplasia.

Keywords: cortisol, surgery, orthopedics, hip dysplasia.

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INTRODUCTION

Hip dysplasia has been described as disease of genetic origin. Great difficulty to stand up and lay down can be seen in the affected animals and in these moments vocalization because of pain sensibility is normally present [1]. Many techniques are indicated for the treatment of these cases and new researches have been developed aiming at obtaining more effective and less bloody techniques [2]. It was reported the dorsal acetabular denervation technique [10] with an analgesic objective, performing the selective neurectomy of sensitive fibers from the joint capsule [15]. For this purpose, the semi-circular removal of the periosteum is done, starting at the craniodorsal margin and going towards the dorsal area of the acetabulum. A classic study [11] reported good results with the denervation in 117 dysplastic dogs and after 10 years of experience (269 dogs). It was obtained a 92% success rate in the improvement of claudication and cessation of pain. It was verified the presence of nervous fibers in all the extension of the acetabular periosteum, even if in higher concentration in the craniolateral portion. Technique initially proposed was modified, by performing a dorsal acetabular denervation [5,16]. Independently of the clinical results pointed out by different authors, no studies referring to the pain parameters accepted by researchers regarding the assessment of this technique are available in the literature, like the serum levels of cortisol and glycemia [4,9,13,14], in studies on the pain control.

The aim of this study was to assess the change in serum cortisol levels and glycemia in patients submitted to the dorsal acetabular denervation technique.

MATERIALS AND METHODS

The eleven dogs evaluated were males and females, without any specific racial predisposition, having hip dysplasia confirmed by clinical and radiographic examinations and no other clinically diagnosed diseases.

The serum levels of cortisol and glycemia were analyzed in moments 0, I, II and III, which were respectively the moment of the diagnosis, 2, 7 and 15 days after the surgical procedure. Meloxican was prescribed to all patients as an antiinflammatory therapy at a dose of 1 mg/kg of body weight, every 24 h by oral route, at the moment of the diagnosis, continuing for 3 days after the surgical intervention and cephallexin, at the dose of 25 mg/kg of body weight, by oral route every 12 h, starting after the surgical intervention and continuing for 7 days. Further therapy includes tramadol sulphate, at the dose of 2 mg/kg of body weight and sodic dipyrone at the dose of 25 mg/kg of body weight, both administered orally for a two-day period after the surgical procedure. All the patients were submitted to the surgical intervention called dorsal acetabular denervation [5]. They were medicated previously to the surgery with acepromazine at the dose of 0,1 mg/kg by intramuscular route and fentanyl acetate at the dose of 0,05 mg/kg by intravenous route. The anesthetic induction was performed using intravenous injection of propofol at the dose of 3 mg/kg, with volatile inhalatory anesthetic maintenance using isoflurane as the anesthetic maintenance agent.

The plasmatic glycemia measurement was performed using blood samples of 3 mL of venous blood drawn by venopunction, in a test tube containing the anticoagulant sodium fluoride and centrifuged afterwards. The colorimetric enzymatic method was used for glucose measurement and the reading was performed using a spectrum photometer (model E-205D coupled to the kinetic system model SB-215P, CELM©). For the serum measurement of cortisol, venous blood samples were drawn by venopunction and stored for coagulation and posterior centrifugation. Subsequently, the samples were stored in siliconized tubes and kept in the freezer until the moment of the quantitative measurement using the ELISA method.

To avoid any alteration in the serum cortisol levels due to variations related to the time of collection or to the patient’s stress, the latter were kept in an isolated environment for 10 min with the presence of the owners and no external stimuli, previously to each blood collection. All the collections were performed by the same evaluator and at the same time of the day, this way minimizing any possibility of alteration in the obtained results.

The statistical analyses were processed with the help of a computerized statistical program (Minitab Release 13, 2000). The final data obtained were analyzed regarding their parametric distribution using the Kolmogorov-Smirnov test. The analyzed data presented a parametric distribution and had means compared by the Tukey’s analysis of variance. Differences with $P$ values equal or smaller than 0.05 were considered significant. The correlation between the glycemia and serum cortisol values was evaluated by the Pearson test.
RESULTS

The statistical analysis of the results points out a significant difference regarding the cortisol levels (µg/dL) at moments M1 and M2 regarding the moment M0, and at moment M3 regarding the other moments observed (Table 1 and Figure 1).

There was no significant statistical difference for the analyzed moments regarding the glycemia (mg/dL) of the patients (Table 1 and Figure 2).

There was a low correlation between the serum glycemia and cortisol levels when compared by the Pearson correlation test.

Table 1. Means and standard deviation of presented values for the studied groups, referent to the parameters of cortisol (µg/dL) and glycemia (mg/dL).

<table>
<thead>
<tr>
<th></th>
<th>M0</th>
<th>M1</th>
<th>M2</th>
<th>M3</th>
</tr>
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<tbody>
<tr>
<td>Cortisol</td>
<td>4,56 ± 3,20&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3,64 ± 3,08&lt;sup&gt;b&lt;/sup&gt;</td>
<td>3,87 ± 3,32&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1,39 ± 0,86&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Glycemia</td>
<td>91,91 ± 9,93&lt;sup&gt;a&lt;/sup&gt;</td>
<td>96,36 ± 6,73&lt;sup&gt;a&lt;/sup&gt;</td>
<td>97,55 ± 6,76&lt;sup&gt;a&lt;/sup&gt;</td>
<td>93,27 ± 8,33&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Different letters indicate significant differences between moments, inside each analyzed group.

Figure 1. Boxplots of serum cortisol (µg/dL) values, from dogs submitted to acetabular denervation. Solid marks are means; *Discrepant values; Different letters indicate significant differences between moments.

Figure 2. Boxplots of serum glycemia (mg/dL) values, from dogs submitted to acetabular denervation. Solid marks are means; *Discrepant values; Different letters indicate significant differences between moments.
DISCUSSION

Since the description of the hip dysplasia in 1937, several authors have searched for the best treatment for this disease. Different techniques were proposed, from the option of conservative treatment to complex and expensive surgical techniques like the alopachroplasty. The denervation of the coxofemoral joint capsule has demonstrated satisfying clinical effects, not only from the owner’s point of view but also through physical examination, even two days after surgery [6], results effectively faster than any other technique described. However, the evaluations presented are subjective, demonstrating only the indications of questionnaires and physical examinations, not evaluating the cessation of the algesic state presented by these patients in a qualitative and quantitative manner.

The pain can be considered a stress factor and hence results in a neuroendocrine response due to the stimulus of the hypothalamus-hypophysis-adrenals axis [8] leading to an increase in the plasmatic levels of cortisol and consequently the occurrence of leukocytosis, an increase in protein catabolism, negative nitrogen balance, hyperglycemia and alterations in the water and electrolyte levels [12]. This is why the measurement of cortisol is an excellent parameter for the assessment of the neuroendocrine modulation of pain [3,13,17], although it is strongly influenced by factors like fear, excitement, anxiety and previous experiences with pain [7], apart from the normal endocrine activity of the organism, which presents variations in production and release of these components during the day.

Aiming at minimizing the variations described, the blood collections were performed by the same observer in a quiet environment with no external stimuli. With the intention of minimizing the influence of the environment in the analyzed samples, it was decided to keep all the patients with no manipulation or stimuli and in the presence of their owners, inside the ambulatory for ten minutes, so the patient would not see the situation as adverse.

In the present study, it was possible to demonstrate the lowering of the serum levels of cortisol at moment M1 (two days after the surgical procedure) regarding the M0 (moment before the procedure), and the same fact was repeated at moment M2 (7 days after the intervention). The initial difference can certainly be influenced by the administration of analgesic and anti-inflammatory drugs. Nevertheless, the repetition of the difference at the following moment, with no use of any analgesic agents, shows the efficacy of the procedure. These data were confirmed by the significant decrease in the mean of the numbers presented at M3 (15 days after the procedure) regarding the other analyzed moments. The presence of a discrepant value noted at moment M3 can represent a difficulty in working with serum cortisol, because the possibility of presenting the variations already discussed can affect the obtained results.

All the patients were normoglycemic at all studied moments, indicating that the manipulation and the stress caused by the samples collection did not interfere significantly with the observed results. The low correlation existent between the cortisol and serum glycemia values show the subjectivity of pain evaluation through serum glycemia, because the patients can be normoglycemic in evident algesic state.

The results pointed out corroborate the ones described by others researchers [6], in which in only 7 days after the surgical intervention, owners reported that the animal presented good or very good quality of life in 51% of the evaluated cases. In the same period, according to the owner’s evaluation, 60% of the animals presented minimal pain, whereas all animals presented significant pain at the pre-surgery moment. This fact is the main benefit in relation to this technique. Animals presenting better quality of life, with no apparent pain demonstrate more joy and movement amplitude, which is also satisfying to their owners who, in all cases, reported a decrease in their personal suffering and agony that they experienced while watching their animals suffer.

CONCLUSION

The modified dorsal acetabular denervation technique was effective in reducing the pain in eleven dogs with hip dysplasia, shown by the decreasing of serum cortisol tested in those dogs.

Ethical approval. This experiment was approved and performed under the guidelines of Ethics Committee for Animal Use of Veterinary College of State University of São Paulo.

Declaration of interest. The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.
REFERENCES


