Haematological and some biochemical parameters in puppies with carpal laxity syndrome

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SUMMARY

The aims of this study were to compare some laboratory parameters found in puppies with carpal laxity syndrome (Group I, n = 12) and in healthy controls of the same age (Group II, n = 10) and to determine the effectiveness of bandage application as treatment. The affected puppies presented bilateral flexion and/or extension (n = 7) or unilateral deformity (n = 5) which were not associated with radiographic signs. No significant difference for haematological parameters and for plasma Ca and P concentrations was evidenced between the 2 groups but the plasma ALP (alkaline phosphatase) activity was markedly increased in the diseased group, suggesting an intense osteoblast activity. The application of polyvinyl chloride (PVC) bandage renewed at 10-day interval has greatly alleviated the joint deformity within 15 days for 75% of puppies and within 45 days for 100% of them. These results suggest that bone formation could be partially altered during the carpal laxity syndrome in dog and that bandage would promote an adequate osteogenesis.

Keywords: Carpal laxity, puppy, ALP, bandage, haematology.

RÉSUMÉ

Quelques données hématologiques et biochimiques chez les chiots atteints du syndrome de laxité carpienne

Les objectifs de cette étude étaient, d’une part de comparer certaines données hématologiques et biochimiques obtenus chez des chiots présentant un syndrome de laxité carpienne (groupe I, n = 12) avec des chiots cliniquement sains de même âge (groupe II, n = 10) et d’autre part, de vérifier l’efficacité thérapeutique d’un bandage de l’articulation. Les chiots atteints ont présenté des déformations en hyperflexion et/ou des hyper-extensions de façon bilatérale (n = 7) ou unilatérale (n = 5) qui n’ont pas été accompagnées de signes radiologiques visibles. Les paramètres hémato-logiques de même que les concentrations plasmatiques en Ca et en P n’ont pas varié de façon significative entre les 2 groupes. En revanche, l’activité plasmatique des PAL (phosphatases alcalines) a fortement augmenté dans le groupe des malades suggérant ainsi une intense activité ostéoblastique. L’application d’un bandage en PVC (chlorure de polyvinyl) renouvelé tous les 10 jours a considérablement corrigé les déformations articulaires en moins de 15 jours dans 75 % des cas et en 45 jours pour 100 % des cas. Ces résultats suggèrent que la formation osseuse est au moins partiellement altérée au cours du syndrome de laxité carpienne et que le port d’un bandage peut favoriser une ostéogenèse adéquate.

Mots clés : Laxité carpienne, chiot, PAL, bandage, hématologie.

Introduction

The carpal laxity syndrome is defined as carpal hyperflexion or hyperextension of the carpal joints [9]. Hyperflexion and hyperextension occur separately or simultaneously on both legs or on only one leg. Poor muscle tone or deficiencies between the extensor and flexor muscles, excessive exercise, ligament deficiencies due to an excessive weight gain before adequate bone development [1, 10] and unbalanced growth may play a role in aetiology of the carpal laxity syndrome [1, 5, 6, 10, 12], but no alteration in mineral metabolism has been reported [2, 5]. This syndrome in puppies is frequently seen in rapidly growing medium, such as large and giant breeds [15]. Moreover, some breeds (like Doberman, Pinscher and Sharpie) would be predisposed to carpal flexural deformities [11]. Sex was not identified as a risk factor [2, 5]. Carpal hyperflexion or hyperextension was not associated with pain in slight or severe forms [2, 5, 11].

Although this syndrome may spontaneously be attenuated, some treatment methods such as balanced diet, moderate and appropriate exercises, the Robert Jones bandaging, splint, tenotomy and arthrodesis have been reported [2, 10, 11, 13, 15]. The aims of this study were to investigate the possible factors involving in aetiology of the carpal laxity syndrome and to determine the rate of improvement for the puppies received treatment by bandages, exercise or diet programs.

Materials and Methods

ANIMALS

This study was conducted on 12 puppies exhibiting carpal deformities (group I) and on 10 healthy puppies (group II). The group I was constituted with 8 males and 4 females, belonging to the following breeds: Anatolian shepherd dog...
(n = 4), German shepherd dog (n = 2), English setter (n = 2) and mixed breeds (n = 4). The mean age in this group was 7.2 ± 3 weeks. In the group II, there were 6 males and 4 females, 6 Anatolian shepherds and 4 mongrels; the mean age was 8.1 ± 1.5 weeks. Moreover, the diet regimen, the vaccination status, the duration of the disorder and previous treatments were recorded in each case. The affected legs were supported with polyvinyl chloride bandage for one month long period and renewed at 10-day intervals.

COMPLEMENTARY ANALYSES

Following clinical examination, anterio-posterior and medio-lateral radiographs (Poscom 35 mA Portable X-Ray Unit, South Korea) of the areas distal to the elbow joint were taken.

After puncture (with a 25-gauge needle) of the right cephalic vein, blood samples (2 mL per tube) were collected into 2 tubes, one tube containing EDTA (ethylenediaminetetraacetic acid) for measurements of haematological parameters using a blood count device (Vetmedonic 500, Switzerland) and the other containing lithium heparinate for biochemical analysis. After centrifugation (3 000 g, 4°C, for 10 minutes), the plasma samples were carefully harvested and stored at -20°C until analysis. The plasma ALP activity and plasma calcium and phosphate concentrations were determined spectrophotometrically (Shimadzu 1208 UV/Visible model spectrophotometer, Japan) with commercially available kits (Biolabo, France).

STATISTICAL ANALYSIS

Data were analysed with the SPSS 15.0 statistical package programme (SPSS Inc, Chicago, Illinois USA). A independent samples t-test was used to reveal the statistical significance between the two groups. Statistical significance was considered to be $P < 0.05$. The results are expressed as means ± standard deviations.

Results

According to the case history, no puppy was exposed to trauma or systemic infection and all of them have received dry food after weaning. Clinically, 7 puppies from the group I exhibited bilateral flexion or hyperextension whereas the joint deformities were unilateral in the 5 other animals (figure 1). Physical examination revealed no anomaly except for difficulty in walking. Walking was mostly made by pressing on carpal joints. Bandage application corrected the hyperextension and/or hyperflexion status (figure 2) for 6 puppies after 10 days, for 3 puppies after 15 days, for 2 puppies after 30 days and for 1 puppy after 45 days.

Radiographies taken before and after treatment did not indicate any detectable abnormality in the growth plates, bone and cartilage tissue for all cases (figures 3 and 4). Haematological parameters and the plasma Ca and P concentrations did not significantly differ between diseased puppies and healthy controls (Tables I and II) whereas a significant increase of the plasma ALP activity was noticed in the group I ($P < 0.05$).
FIGURE 3: Radiographic view of the front leg of the puppy before treatment (bandage application).

FIGURE 4: Radiographic appearance of the puppy after 14 days of bandage application.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Group I (carpal laxity)</th>
<th>Group II (control)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Erythrocytes</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RBC ($10^{12}$/L)</td>
<td>5.3 ± 0.9</td>
<td>4.9 ± 0.5</td>
<td>0.08</td>
</tr>
<tr>
<td>Hb (g/L)</td>
<td>113 ± 27</td>
<td>112 ± 14</td>
<td>0.43</td>
</tr>
<tr>
<td>Ht (%)</td>
<td>32.0 ± 2.5</td>
<td>33.4 ± 2.3</td>
<td>0.10</td>
</tr>
<tr>
<td>MCV (fL)</td>
<td>64.2 ± 6.4</td>
<td>69.3 ± 9.1</td>
<td>0.08</td>
</tr>
<tr>
<td>MCH (pg)</td>
<td>19.3 ± 1.3</td>
<td>19.7 ± 1.1</td>
<td>0.19</td>
</tr>
<tr>
<td>MCHC (g/L)</td>
<td>341 ± 24</td>
<td>326 ± 18</td>
<td>0.06</td>
</tr>
<tr>
<td><strong>Leukocytes</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WBC ($10^9$/L)</td>
<td>11.9 ± 2.4</td>
<td>11.8 ± 2.0</td>
<td>0.45</td>
</tr>
<tr>
<td>Neutrophil ($10^9$/L)</td>
<td>7.8 ± 0.6</td>
<td>8.1 ± 0.5</td>
<td>0.12</td>
</tr>
<tr>
<td>Lymphocyte ($10^9$/L)</td>
<td>4.0 ± 0.8</td>
<td>4.6 ± 1.1</td>
<td>0.11</td>
</tr>
<tr>
<td>Monocyte ($10^9$/L)</td>
<td>2.6 ± 0.9</td>
<td>2.3 ± 0.6</td>
<td>0.17</td>
</tr>
<tr>
<td>Eosinophil ($10^9$/L)</td>
<td>0.6 ± 0.3</td>
<td>0.7 ± 0.2</td>
<td>0.40</td>
</tr>
<tr>
<td><strong>Thrombocytes</strong> ($10^9$/L)</td>
<td>471.4 ± 18.9</td>
<td>461.2 ± 28.6</td>
<td>0.18</td>
</tr>
</tbody>
</table>

**TABLE I:** Haematological parameters in puppies with carpal laxity syndrome (group I, n = 12) and in healthy puppies (group II, n = 10). 
Results are expressed as mean ± standard deviation.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Group I (carpal laxity)</th>
<th>Group II (control)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALP (U/L)</td>
<td>301.8 ± 31.4</td>
<td>153.2 ± 30.7</td>
<td>0.00</td>
</tr>
<tr>
<td>Calcium (mmol/L)</td>
<td>0.27 ± 0.02</td>
<td>0.26 ± 0.02</td>
<td>0.15</td>
</tr>
<tr>
<td>Phosphate (mmol/L)</td>
<td>0.17 ± 0.02</td>
<td>0.16 ± 0.02</td>
<td>0.17</td>
</tr>
</tbody>
</table>

**TABLE II:** Biochemical parameters in puppies with carpal laxity syndrome (group I, n = 12) and in healthy puppies (group II, n = 10). 
Results are expressed as mean ± standard deviation.
Discussion

The carpal laxity syndrome has been commonly reported in foal, pigs and lambs but rarely in dogs [7, 14, 15]. However, among the animals referred to the clinic from Kayseri region, this syndrome was identified more frequently in puppies than in the other animals: within the all cases referred here for a 1 year long period, the clinical prevalence of this disorder was 2.6%, leading to consider the carpal laxity syndrome as relatively frequent in this region in dog.

CETINKAYA et al. [5] observed this syndrome in 5-27 weeks old puppies and ALTUNATMAZ and ÖZSOY [2] reported a more restricted age interval (6 – 8 weeks). In the diseased group, the puppies were 7.2 ± 3 week old in average that was similar to the above studies. This clinical entity was essentially reported in puppies with an accelerating growth [2, 3, 5, 8, 14] and mainly in Anatolian sheep dog and mixed breed [2, 5]: in the present study, the affected puppies also mainly belonged to large breeds (Anatolian and German shepherds, mixed breeds).

On the other hand, VAUGHAN [15] has suggested that these disorders are hereditary in Doberman Pinscher whereas ALTUNATMAZ and ÖZSOY [2] have emphasized that the main cause of the carpal laxity syndrome may be related to nutrition since they have observed it in different breed varieties. In the same way, AUER [3] and WAGNER et al. [14] have suggested that the deformities occurred in foals may be due to intense and unstable intake of carbohydrate and protein and lack of Cu and Zn. Moreover, in the present study, the deformities have appeared approximately 2 weeks after that puppies have been separated from their mother as it was previously reported by ALTUNATMAZ and ÖZSOY [2]. At this time, the puppies were fed with unbalanced diets and their care was unsatisfactory.

Haematological parameters were within usual values for all dogs in the Group I except for one dog (Table I), whose the erythrocyte count, the haemoglobinemia and the hematocrit were depressed but associated to normocytic and normochromic anaemia. In addition, plasma Ca and P concentrations were within usual values in the present study. However, ALTUNATMAZ and ÖZSOY [2] found a slightly increase of these 2 biochemical parameters in 22.6% of puppies with carpal laxity syndrome. Nevertheless, in the present study, plasma ALP activity was dramatically enhanced in the group I compared to the healthy controls, suggesting a strong osteoblast activity or hepatopathies [4]. Because of the clinical status of the puppies with carpal laxity syndrome and the absence of major haematological alterations, hepatopathies can be discarded. The intense bone formation suggested by the increase of plasma ALP activity would be associated with an increased mineral fixation, leading to a normalization of the plasma Ca and P concentrations. It would be also possible that a vitamin D deficiency would promote disequilibrium between bone formation and resorption. Vitamin D metabolites regulate the calcium metabolism and therefore skeletal development in dogs. These metabolites aid in the absorption of calcium and phosphorus from the gut, increase bone cell activity, and influence enchondral ossification and calcium excretion [9]. Bandage application was considered to be helpful to improve osteogenesis by diminishing constraints on bones and provided the shortening of the laxited flexor and extensor tendons.

As a conclusion, the carpal laxity syndrome is no rare in dog in the Kayseri region and may be treated with balanced diets, notably for Ca and P supply, and controlled bandage application. However, further studies investigating epidemiological factors (mainly breed and age at the weaning), diet analysis, haematological and biochemical status in a larger number of the affected puppies are necessary for evaluating the intensity of bone formation and identifying some inherent aetiological conditions.

References