A clinical case of secondary renal hyperparathyroidism in a four-month-old Pug puppy

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SUMMARY

The paper describes a clinical case of fibrous osteodystrophy in an young dog with secondary renal hyperparathyroidism. Significant deviations in blood biochemical parameters, radiological and ultrasonography findings and histological findings of kidneys, skull and skeletal bones have been observed. In our view these changes were relevant and could be successfully used for diagnostics of this specific pathology.

Keywords: Fibrous osteodystrophy, secondary renal hyperparathyroidism, parathyroid hormone, chronic renal failure, dog.

RÉSUMÉ

Hyperparathyroïdie secondaire rénale chez un chiot Carlin de quatre mois - cas clinique

Un cas clinique d’ostéodystrophie fibreuse dans un chiot souffrant d’hyperparathyroïdie secondaire rénale est présenté. Déviations des taux sanguins biochimiques, l’image radiologique, les résultats de l’échographie et de histologie des reins, les os de la face et du squelette ont été observés. À notre avis, les changements sont important et peuvent être utilisées avec succès pour le diagnostic de cette pathologie spécifique.

Mots clés : Ostéodystrophie fibreuse, hyperparathyroïdie secondaire rénale, parathormone, insuffisance rénale chronique, chien.

Introduction

Secondary hyperparathyroidism of renal origin is a common sequel of chronic renal failure (CRF) [2]. It results from the action of various factors leading to progressive loss of glomerular and tubular function and phosphates retention. Such alterations are most frequently present in: interstitial nephritis, glomerulonephritis or amyloidosis in adult dogs, as well as congenital renal abnormalities in young animals [5]. Although the secondary renal hyperparathyroidism and renal osteodystrophy are known effects of CRF, clinically important renal osteodystrophy is rarely reported in dogs and cats [2, 13]. A survey performed in 1986-1994 in the Veterinary Hospital of the University of Pennsylvania with dogs with CRF syndrome provided evidence that in only four animals (1.4%), fibrous osteodystrophy was clearly manifested clinically [18]. In dogs, the condition is more commonly manifested at a young age as metabolically active growing bones are more sensitive to adverse effects of PTH [13]. SVOBODA et al. [20] found secondary renal hyperparathyroidism in four dogs of large breeds as the age of diseased dogs was from 3.5 to 20 months. In the present report, we describe a case of secondary hyperparathyroidism with extensive skeletal and skull deformities (fibrous osteodystrophy) in a Pug puppy with symptoms of renal failure. The interesting findings in this case consist in the combined expression of osteodystrophy signs specific for both early and adult ages.

Clinical case

HISTORY

A four-month-old female Pug dog weighing 870 g was referred to the Small Animal Clinic of the Faculty of Veterinary Medicine, Trakia University – Stara Zagora in February 2010. Twelve days before the owner has observed difficulties in food ingestion and a strong deformation of forelimbs. The dog has been treated with Synulox tablets 50 mg (40 mg amoxicillin and 10 mg clavulanic acid; Pfizer, USA), Prednisolon tablets 5 mg (0.5 mg/kg; Actavis, Bulgaria) and Calci-delice tablets (Phosphorus 305 mg; Fluor 0.875 mg; Calcium 545 mg; VitaminD3 150 UI; Virbac; France), but without result. The patient accepted only soft food and has lost a considerable part of its body weight.

CLINICAL DATA

The physical examination of the patient revealed a poor body condition and a markedly slowed growth with bilateral mandibular and maxillary swellings and considerably deformed antebrachial bones (Figure 1). The jaws were flexible, and deciduous and permanent teeth exhibited a marked mobility during the examination. The most significant deviations were observed in antebrachial bones’ consistency – they were painful, very deformed and markedly pliable.
SECONDARY RENAL HYPERPARATHYROIDISM IN A PUG PUPPY

DIAGNOSTICS

Blood was sampled for complete blood counts and biochemical profile analysis. The results revealed a severe renal disorder that further necessitated the analysis of PTH concentrations. At the same time, urinalysis, abdominal ultrasonography and radiography of skull and skeletal bones were also performed.

The deviations in blood and urine constituents are shown in Table 1. Nitrogen containing compounds (creatinine and urea), inorganic phosphate and alkaline phosphatase (ALP) were strikingly elevated over reference values. The total and ionized calcium levels were below the reference intervals [18]. The most prominent increase was observed in blood PTH concentrations.

The radiography of jaw bones demonstrated thinned cortices and local cystic lucid areas of increased transparency. The tooth roots were clearly defined but lacked alveolar bone plates (Figure 2). Similar radiological signs were present in long bones of the limbs, that showed subperiosteal erosions, thinned compacta, generalized osteoporosis and transparency foci (Figure 3).

Ultrasonography has shown that kidneys were of a normal size and irregular margins. Hypoechoic changes in the cortex and the core were present. The elements of the normal kidney anatomy were hardly distinguished (Figure 4).

The dog was euthanized because of the poor prognosis and the impossibility for correction of the congenital renal disease. Then autopsy was performed and material for histological study was collected from the kidneys, jaw and tubular bones.

The gross anatomy examination of kidneys showed that they were of normal size and shape, with a grey-whitish cut surface, and the microscopic study revealed a marked granular dystrophy of epithelial cells lining renal tubules (arrow) (Figure 5).

The consistency of antebrachial bones and at a lesser extent of skull bones was soft and elastic and could be easily cut with a knife. Histological, bone tissue reduction (atrophy) and substitution of bone with connective tissue (fibrous osteodystrophy) were present (Figure 6).

**TABLE I: Abnormal laboratory results in a puppy with renal hyperparathyroidism.**

<table>
<thead>
<tr>
<th>Constituent</th>
<th>Value</th>
<th>Reference Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Creatinine, µmol/L</td>
<td>481.0</td>
<td>40-120</td>
</tr>
<tr>
<td>Urea, mmol/L</td>
<td>21.43</td>
<td>1.7-7.4</td>
</tr>
<tr>
<td>Calcium, mmol/L</td>
<td>1.49</td>
<td>2.4-2.8</td>
</tr>
<tr>
<td>Ionized Ca, mmol/L</td>
<td>0.64</td>
<td>1.25-1.48</td>
</tr>
<tr>
<td>Phosphorus, mmol/L</td>
<td>6.14</td>
<td>0.94-1.52</td>
</tr>
<tr>
<td>ALP, U/L</td>
<td>393.6</td>
<td>35-169</td>
</tr>
<tr>
<td>PTH, pmol/L</td>
<td>81.16</td>
<td>2-13</td>
</tr>
<tr>
<td>Urine</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Colour</td>
<td>Pale yellow</td>
<td></td>
</tr>
<tr>
<td>Specific density</td>
<td>1.012</td>
<td></td>
</tr>
</tbody>
</table>

The consistent of antebrachial bones and at a lesser extent of skull bones was soft and elastic and could be easily cut with a knife. Histological, bone tissue reduction (atrophy) and substitution of bone with connective tissue (fibrous osteodystrophy) were present (Figure 6).
Discussion

PTH is a polypeptide that enhance osteoclastic activity and consequently, calcium and phosphates are released from bones. Osteoclasts do not possess receptors for PTH but such are found in osteoblasts. The activation of osteoclasts however is only possible in the presence of osteoblasts [6, 1]. It is proved that PTH provokes decreased calcium excretion by kidneys with higher excretion of phosphates, that results in lower blood serum phosphate concentrations regardless of the enhanced bone resorption [10, 1].

In chronic renal failure, the production of 1,25-dihydroxycholecalciferol in kidneys is reduced, leading to slower intestinal transport of calcium and occurrence of hypocalcaemia [5, 9, 21]. For maintenance of calcium homeostasis, an enhanced resorption of calcium from bones occurs [3, 9], and the released mineral bone substances are replaced with immature fibrous connective tissue [8, 17].

In dogs, skull and mandibular bones are most vulnerable and most severely affected by demineralization and could be changed to an extent such that teeth are mobilized and the mandible bends without fracturing (“rubber jaw” syndrome) [8, 19]. The skull and mandibular bones in cats are not prone to renal osteodystrophy [2, 4, 14,]. Pathological fractures are rarely seen in dogs and cats with CRF [16]. Other possible signs of the severe renal osteodystrophy include skeletal decalcification, bone cysts, bone pain and stunted growth bone calcification and secondary pathological fractures are usually observed in the latest stages of CRF [3].

The pathological hyperostotic osteodystrophy is more commonly observed in jaw bones of young dogs whereas generalized osteodystrophy accompanied with rubber jaw is more specific for the adult age [12]. In young animals, the deposition of osteoid by hyperplastic osteoblasts and the repair by means of fibrous connective tissue proliferation exceeds the bone resorption rate and consequently, hyperostotic bone lesions are formed [5]. In a five-month-old Great Dane with renal cortical hypoplasia, enlargement of facial bones and the mandible have been reported, that were fairly similar to the present case [15]. The same clinical changes have been described by us in an 11-month-old Caucasian shepherd dog [17]. In severe hyperparathyroidism, the osteoclastic resorption rate is higher than that of osteoblastic accretion and that is why bone mineralization could be completely absent [10]. The activity of osteoblasts is also considerably enhanced and they release large amounts of ALP. The higher serum activity of this enzyme are important for diagnosing hyperparathyroidism [10] and they were assayed in this case as well.

The diagnosis of secondary renal hyperparathyroidism is based on clinical signs, radiological findings for demineralization of skeletal and facial bones and blood laboratory analysis evidencing a chronic renal failure. The increased serum PTH concentrations, hyperphosphataemia and low total and
ionized calcium levels established in this clinical case are a common findings [7, 22]. We have not however observed the typical signs of CRF as vomiting, dehydration, polydipsia and polyuria.

From the point of view of differential diagnosis, some neoplasms causing swelling of jaws should be also considered. Most tumours of the oral cavity occur in adult animals. Fibrosarcoma is more common for large dog breeds whereas the papillary squamous cell carcinoma could be encountered at an young age [11]. In this case, the probability for an oral tumour was very low because of the symmetry of the slight swelling of upper and lower jaw and the concomitant presence of considerable bone deformities outside the mouth.

The case described herein is a contribution to the clinical and laboratory database of canine fibrous osteodystrophy due to renal hyperparathyroidism.

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References