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Angular Limb Deformities in a Giant-Breed Puppy

A 6-month-old male, 47-kg Tosa-Ken was presented for lameness with bilateral carpal valgus.

History. Beginning 2 months prior to presentation, the dog demonstrated signs of worsening bilateral angulation of the distal extent of the antebrachia; the right forelimb was more severely affected than the left (**Figure 1**). The patient was being fed a homemade diet of raw whole chicken, vegetables, vitamins, and minerals. With onset of forelimb deformities, the dog was treated with 1500 mg vitamin C Q 12 H; there was no improvement.

Physical Examination. Carpal valgus was present bilaterally but worse on the right side. The dog was moderately overweight with a body condition score (BCS) of 7/9. Pain was present on flexion of the right carpus and right forelimb manus; the right carpus and digits knuckled over when the patient walked.

Imaging. Radiographs of both antebrachia were obtained. Bilateral mild carpal valgus centered at the antebrachial carpal joint with foreshortening of the ulnas was present (**Figure 2**). The right third and fourth metacarpals had distal valgus deformities involving the distal physes (**Figure 3**).

continues



Appearance of patient at presentation. Note the bilateral radial carpal angular limb deformity as well as the right metacarpal angular limb deformity.



Craniocaudal radiograph of the right antebrachium. Note the mild carpal valgus centered at the antebrachial carpal joint.



Dorsopalmar radiograph of the right carpus and metacarpals showing distal valgus deformities involving the distal physes of the third and fourth metacarpals.

ASK YOURSELF...

Given the age and breed of the dog presented here, what are the most appropriate diet changes you would recommend to the client?

- A. Continue with the current diet of raw chicken, vegetables, vitamins, and minerals.
- B. Recommend the addition of vitamins C and D to the home diet.

- C. Recommend an adult maintenance commercial diet for large/giant breed dogs that is fed in accordance with the dog's calculated energy requirements.
- D. Recommend a puppy-stage commercial diet for large/giant breed dogs that is fed in accordance with the dog's calculated energy requirements.

BCS = body condition score

CORRECT ANSWER:

C. Recommend an adult maintenance commercial diet for large/giant breed dogs that is fed in accordance with the dog's calculated energy requirements.

Developmental orthopedic disease has multifactorial causes, including excess calcium and phosphorus intake, genetics, overnutrition, trauma, and ischemia.¹ The homemade diet was most likely not balanced for this giant-breed puppy's energy, calcium, phosphorus, and vitamin D requirements.

In one study, overnutrition and excess energy consumption in Great Dane puppies increased the incidence of developmental orthopedic disease.² Calorie restriction has been implemented in commercial large-breed puppy foods by limiting the energy density to 3.5 to 4 kcal/g and 12% fat content, which limits growth rate and fat deposition.

Bone Disorders & Diet. High-fat diets may result in increased levels of insulin-like growth factor-1 and increased bone formation, leading to bone deformities such as those seen in the case presented here.³

In addition, developmental bone diseases, such as angular limb deformities, have been linked to excess dietary calcium intake as well as calcium–phosphorus ratios greater than 1.2 to 1.^{1,4,5} Many home-cooked and raw-food diets have high phosphorus contents but restricted calcium content, which causes nutritional secondary hyperparathyroidism.¹ The result is asynchronous growth of the long bones due to imbalance of mineral accretion and resorption.¹

Vitamin supplementation can also result in developmental bone disease in large-breed puppies. Excess vitamin D supplementation can alter skeletal development, but more research is needed to determine the mechanism of this process. Commercial diets contain ample levels of vitamin D and no additional supplementation is recommended at this time.¹

Treatment. Since this puppy was overweight, the recommended diet was a large-breed maintenance adult dog food fed according to the following formula:

$$\begin{aligned} \text{RER} &= 30(\text{body weight}_{\text{kg}}) + 70 \\ 1.6 \times \text{RER} &= \text{maintenance energy requirement} \\ &(\text{kcal/day}) \end{aligned}$$

If the puppy had not been overweight (eg, BCS less than 4.5/9), the recommended diet would have been a large-breed puppy food fed at $2 \times \text{RER}$ until 1 year of age.¹

In addition to the diet changes, bilateral distal ulnar osteotomies and T-plate fixation of distal third and fourth right metacarpal angular deformities were performed (**Figure 4**).⁶



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Craniocaudal radiograph of the right antebrachium 1 month postoperatively and following recommended dietary changes. There has been resolution of the carpal valgus at the antebrachial carpal joint with ulnar osteotomy; the third and fourth distal metacarpal valgus deformities have been corrected with wedge osteotomies and T-plate fixation.

Carpal Laxity Syndrome

This dog may have had a component of carpal laxity syndrome, which results in hyperextension or hyperflexion of the carpal joints in puppies. Carpal laxity syndrome may be the result of unbalanced growth or poor muscle tone between the carpal flexors or extensors.^{7,8} It most commonly occurs in large- and giant-breed dogs; immature dogs often develop this condition as a result of excessive weight gain before adequate bone development.^{7,8}

Treatment for carpal laxity syndrome is multimodal and includes feeding a balanced diet, applying splints and/or Robert Jones bandages, and limiting exercise to surfaces with good traction. The prognosis for most dogs is good, and the condition is often self-limiting with resolution of clinical signs within 1 to 4 weeks of treatment.^{7,9}



BCS = body condition score; kcal = kilocalorie; RER = resting energy requirement

Follow-Up & Outcome. Determination of BCS and body weight were performed every 2 weeks. The energy intake and amount of food consumed by the puppy were altered as needed. Within 4 months there were no signs of angular deformities in either forelimb and all lameness had resolved. ■

See **Aids & Resources**, **back page**, for **references, contacts, and appendices**.
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Take-Home Messages

- Dietary requirements of large-breed puppies are markedly different from those of other breeds. A strict feeding regimen prevents or at least decreases the incidence of developmental orthopedic diseases.
- Calorie as well as dietary fat, calcium, and phosphorus requirements must be carefully regulated. BCS should be monitored closely in order to decrease the incidence of orthopedic disease.

practice hotline

NEW PRODUCTS & UPDATES

Identity Theft Legislation

Beginning this month, veterinarians are required by the Federal Trade Commission to have plans to prevent identity theft. Practices are required to identify possible security breaches, flag them as potential problems, and design and execute a plan to detect, prevent, and handle future identity theft threats. Additional information is available at ftc.gov/bcp/edu/pubs/articles/art11.shtm.—*Press release 4/2009*

New Vectra Outlet

Vectra ectoparasiticide (abbottanimalhealth.com) products are now available for direct shipment through Summit VetPharm (summitvetpharm.com) as well as through Abbott Animal Health sales representatives.—*Press release 3/2009*

"Green" IV Stabilizer

G&B Marketing (gandbmarketing.com) has introduced an IV stabilizer made from biodegradable pulp fiber. According to the manufacturer, the stabilizer prevents occlusion during intravenous infusion with the convenience of no cleaning and a more sterile environment for each patient.—*Press release 3/2009*



DNA Solution to Canine Muscular Dystrophy

The National Institutes of Health has developed a successful treatment for canine muscular dystrophy using patches of DNA—like molecules to replace mutant sequences in a process called "exon skipping." The canine version of Duchenne muscular dystrophy occurs naturally in dogs, and affects the same gene as in the human form of the disease. For more information, visit nichd.nih.gov.—*Press release 3/2009*



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