Claim A Victory Whenever You Can; Even If It Happens Accidentally!

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Class of 2020

Clinicopathological Conference

June 28, 2019

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Introduction

Hypertrophic osteodystrophy is a developmental disorder that affects rapidly growing puppies usually of a large or giant breed. While the exact etiology is unknow, the disease pathophysiology is based on metaphyseal vascular impairment which leads to a failure in ossification of bone. Because Hypertrophic osteodystrophy can present with signs similar to many diagnosis differentials, it is important to conduct thorough physical exams; acquire a detailed history from owner; and execute clear, diagnostic radiographs with careful interpretation of those images. These actions combined with good supportive treatment can, generally, lead to a positive outcome for a young, canine patient.

History and presentation

Franklin was a 5 month old, male, Great Dane puppy who presented to MSU-CVM Surgery department on January 31, 2019 for gait irregularities including “bunny hopping”, abducted toes in his hind limbs, chronically arched back, inability to climb up or extend hind legs, narrowed hips, extremely painful limbs. January 17, 2019, Franklin’s owner noticed he seemed lethargic and uninterested in eating or drinking. He was presented to his local veterinarian where abdominal radiographs were taken, but were inconclusive. There was concern Franklin might have gastric upset or an intestinal blockage. He was prescribed metronidazole, carprofen, famotidine, plus, easily digestible food and was sent home to be monitored. Franklin appeared to improve initially, was willing to eat and eventually defecated. However, on the morning of January 22, 2019, Franklin was unwilling or unable to rise from a reclined position, he was febrile and acted as if his hind limbs were paretic. His regular veterinarian repeated abdominal radiographs, plus took images of his pelvis and stifles. His owner noted that recent defecations were small in size. New radiographs indicated that food was moving through his gastrointestinal

tract, however, to help with any possible gastric upset or pain, sucralfate was added, plus, tramadol for pain. After a few days, Franklin's gastrointestinal signs improved but he continued to act painful and lethargic despite these new medications, so he was referred to MSU-CVM. Upon presentation January 31, 2019 to MSU-CVM Surgical Service, Franklin was bright, alert and responsive to his surroundings. His eyes were clear, ears had little debris within canal nor on pinna. Examination of his mouth revealed missing deciduous teeth as was appropriate for his age. Heart and lungs auscultated appropriately; no arrhythmia or murmurs were appreciated and lungs had appropriate bronchovesicular sounds. His vital parameters were normal with a heart rate of 112 beats per minute; respiration rate of 32 breaths per minute and temperature of 102.2F. Franklin had a body condition score of 3/9. Orthopedic exam revealed Franklin was somewhat painful on full extension of his hips and extremely painful when the tibia, fibula, radius and ulna were firmly palpated. His joints appeared mildly enlarged and were slightly warm and edematous. When approaching him from a distance it was noticeable that his back arched, elbows were slightly abducted with weight shifted to the front limbs, the toes in the hind limbs were abducted and his pelvis appeared narrowed.

Radiographs were taken of his pelvis, tibia, fibula, radius and ulna. Radiographic findings revealed an irregularly marginated lucent line running parallel to physe of both radii, ulnae, tibiae, fibulae, distal femorae and femoral necks. Surrounding the proximal and distal metaphysis of bilateral radius, bilateral ulna, bilateral tibia and bilateral fibula is circumferential periosteal new bone formation. Essentially, Franklin was exhibiting the classic diagnostic radiographic sign of the "double physeal line" on every long bone that was imaged. Further, review of past radiographs taken by the referring veterinarian, also, revealed the presence of "double physeal line" in the femur and tibia.

Pathophysiology

Hypertrophic osteodystrophy is a osteopathic developmental disease of large and giant breed dogs, more commonly male, who are between the ages of two and eight months of age. Over 40 breeds of dogs have been diagnosed with hypertrophic osteodystrophy, but there are strong breed predispositions reported in Weimaraners, Great Danes, Boxers, German Shepard Dogs, and Irish Setters. It was first identified as a disease in the mid 1930's; ninety years later, the etiology remains a mystery (Fetter & Lenehan, 1985). Many causes such as vascular abnormalities, excess vitamin and mineral supplementation, genetics, and even infections such as canine distemper virus and *Escherichia coli* are suspect, but none are proven. Interestingly, the Weimaraner is the "only breed in which entire litters and closely related animals are reported to be affected (Safra, et al., 2013)", eluding to a possible, unknown genetic component. In fact, there are specific, recommended vaccination protocols for canine distemper virus, adnovirus or parvovirus for Weimaraners to avoid the possibility of "vaccine induced" hypertrophic osteodystrophy. Genetic inheritance has not been shown definitively either way, lesions similar to hypertrophic osteodystrophy have been produced experimentally by feeding dogs free-choice diets high in calcium, protein and calories (Demko & McLaughlin, 2005) so nutrition could also play a role; however, "overnutrition is not a consistent finding" (Fetter & Lenehan, 1985). Initial signs, visible histologically, are necrotized capillary loops and disrupted trabeculae within the cartilage of the metaphyseal physis. The superficial periosteal soft tissue surrounding the metaphysis becomes edematous; congestion and hemorrhage ensue. Visible within the line of disrupted trabeculae are hemosiderin, fibrosis and inflammatory cells which in some cases suggest osteomyelitis. This process leads to formation of a collar of bone and metaplastic cartilage, essentially a thickening of the periosteum accompanied by periosteal new-bone

formation often referred to radiographically as a “double physeal line” (Demko & McLaughlin, 2005). Ultimately, there is failure of endochondral calcification due to disruption of the metaphyseal blood supply.

The metaphyseal regions of the long bones, specifically the “distal radius, ulna and tibia” (Balsa & Robinson, 2016) are most often effected and will sometimes “exhibit grossly observable swellings (DeCamp, Johnston, Schaefer, & Dejardin, 2016)”, however they are not the only susceptible locations. Lesions have been identified within the metaphyses of the mandible and maxilla, metacarpals, the scapula, the costochondral junctions of the ribs, the scapula, and even the anterior border of the ilium (Fetter & Lenehan, 1985).

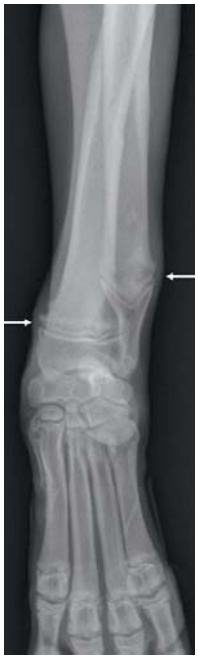
While there has been some recent research into treatment of hypertrophic osteodystrophy, there has not been any new information gleamed regarding etiology. In human medicine there is an extremely rare disease called Jansen Type Metaphyseal Chondrodysplasia that causes inappropriate cartilage formations and ensuing abnormal formation of bone at the metaphyseal portions of long bones. The disease typically becomes apparent during early childhood and individuals exhibit short stature and unusually short extremities. As the disease progresses, children present with a progressively stiffening and edematous joints, and an unusual "waddling gait" and squatting stance. While these signs are similar to hypertrophic osteodystrophy, Jansen Type Metaphyseal Chondrodysplasia is linked to hypercalcemia and is caused by a gene mutation that effects the parathyroid hormone’s ability to regulate calcium levels in the blood (Schipani, 2019). While this disease presents very similarly, hypertrophic osteodystrophy patients do not consistently present with elevated calcium levels nor seem to be affected by endocrine disorders.

Diagnostic approaches and considerations

Lameness in a young dog is an indicator of many differential diagnoses such as septic arthritis, septic physitis, immune-mediated polyarthritis, secondary nutritional hyperparathyroidism, and panosteitis. Panosteitis most closely resembles hypertrophic osteodystrophy in clinical signs, therefore differentiating between them is important and therefore localization is key. A thorough history, physical exam, and diagnostic imaging are the steps to diagnosing hypertrophic osteodystrophy. An orthopedic exam performed in both standing and recumbent positions yields different information. Palpation while standing (weight-bearing) will provide better assessment of joint effusion, while range of motion can be better assessed in a recumbent position. A typical patient effected by hypertrophic osteodystrophy will be acutely lethargic, reluctant to walk with a mild to severe lameness, an arched back and discomfort. Ostealgia localized along the diaphysis of the long bone indicates panosteitis, whereas the distal metaphyseal region of long bones is the area specifically effected by hypertrophic osteodystrophy. Deep, digital palpation of this region will allow identification of pain, edema, firmness and warmth that is generally, bilateral (Buback, 2012). Additionally, animals affected more severely will also be systemically ill and exhibit recurrent episodes of "anorexia, pyrexia, ocular and nasal discharge, skin pustules or nodules, diarrhea, hematochezia, vulvovaginitis, and pathological respiratory sounds". (Grondalen, 1976)

Once palpation of the long bones elicits pain, radiographs are the next essential step. Radiographic findings will reveal an "ill-defined radiolucent line parallel to

the physis causing a ‘double physeal’ appearance” and is considered diagnostic for hypertrophic osteodystrophy. Lacy bone production proximal to the growth plate will give the physis a flared appearance. Taking images of all long bones is recommended as lesions are distributed symmetrically throughout the fore and hindlimbs. (Fabiani, 2011)


(Buback, 2012)

Treatment and management

Treatments for hypertrophic osteodystrophy are nonspecific, intended to alleviate clinical signs of lethargy, fever, and ostealgia. NSAIDs, occasionally opioids, and warm compresses are prescribed to help control pain. However, some dogs fail to respond to “treatment with NSAIDs and had to be switched to treatment with corticosteroids, which suggested that the immune suppressive action of corticosteroids was required to achieve remission (Safra, et al., 2013). Nutritional needs are addressed by switching to a large or giant breed specific food that is lower in calories can slow growth rates. Fluid therapy with enteric medications are used when gastrointestinal signs are present. Preventing long term recumbency is also important, as it leads to pneumonia. (Jaeger, 2010)

Typically, hypertrophic osteodystrophy is self-limiting. An efficient diagnosis combined with appropriate supportive treatment in most uncomplicated cases have a good prognosis. In a recent study, 28 of 33 dogs responded to treatment, medications were discontinued, no relapses occurred and were healthy when they reached adulthood. Evidence supports resolution of hypertrophic osteodystrophy when closure of the physes occurs. However, death does occur in those severely, systemically affected due to metabolic disease, sepsis, secondary bacteremia or euthanasia from constant, severe pain (Jaeger, 2010).

Case Outcome

Franklin was prescribed carprofen (1.65mg/kg) every 12 hours for two weeks with instructions to make an appointment with his regular veterinarian for evaluation and refills of current medications. It was expected that he could experience signs of hypertrophic osteodystrophy for the next six to eight weeks. Regular medication minimized any returning signs he might have experienced and Franklin had no recurring episodes. Franklin's owner reported at the time of this writing that he had filled out physically, was running and romping like a young Great Dane should, and had experience no ill effects of the disease.

It is interesting to note that Franklin's regular veterinarian provided the necessary supportive care by treating his signs, despite not making a diagnosis, which might have contributed to his initial improvement following his first visit. While hypertrophic osteodystrophy is uncommon, it is a disease that appears regularly on board examinations, and is a disease a general, small animal practitioner will see occasionally and should be able to recognize and diagnose on radiographs.

References

Balsa, I., & Robinson, D. (2016, May/June). Juvenile Orthopedic Disease in Dogs & Cats: Part 1 Musculoskeletal Development & Pediatric Bone Diseases. *Today's Veterinary Practice*, 25-47. Retrieved June 7, 2019, from Todays Veterinary Practice: https://todaysveterinarypractice.com/juvenile-orthopedic-disease-in-dogs-cats-part-1-musculoskeletal-development-pediatric-bone-diseases/

Buback, J. (2012, August 01). Evaluating Forelimb Lameness in Juvenile Dogs. *Veterinar News: DVM360*.

DeCamp, C. E., Johnston, S. A., Schaefer, S. L., & Dejardin, L. M. (2016). *Brinker, Piermattel, and Flo's Handbook of Small Animal Orthopedics and Fracture Repair, Fifth Edition.* St. Louis, MO: Elsevier.

Demko, J., & McLaughlin, R. (2005). Developmental Orthopedic Disease. *Veterinary Clinics: Small Animal Practice*, 1111-1135.

Fabiani, M. (2011, May 1). Bone appetit: an appetizer of developmental. *Veterinary News: DVM360*.

Fetter, A. W., & Lenehan, T. M. (1985). *Textbook of Small Animal Orthopaedics - Chapter 50: Hypertrophic Osteodystrophy.* Retrieved from University of Pennsylvania: Veterinary Medicine - Special Projects: http://cal.vet.upenn.edu/projects/saortho/chapter_50/50mast.htm

Grondalen, J. (1976). Metaphyseal osteopathy (hypertrophic osteodystrophy) in growing dogs; a clinical study. *Journal of Small Animal Practice*(17), 721-735.

Jaeger, G. H. (2010). Juvenile Orthopedic Diseases. *Juvenile Orthopedic Diseases.* Washington, D.C.: DVM360.com.

Miller, C. (2001). Hypertrophic Osteodystrophy in a Great Dane puppy. *Canadian Veterinary Journal*, 42, 63-66.

Safra, N., Johnson, E. G., Lit, L., Foreman, O., Wolf, Z. T., Agular, M., . . . Bannasch, D. L. (2013, May 1). Clinical Manifestations, Response to Treatment and Clinical Outcomes For Weimaraners With Hypertrophic Osteodystrophy: 53 Cases (2009-2011). *Journal of the American Veterinary Medical Association, 242*(9), 1260-1266.

Schipani, E. (2019, June 13). *Jansen Type Metaphyseal Chondrodysplasia*. Retrieved from National Organization for Rare Disorders: https://rarediseases.org/rare-diseases/jansen-type-metaphyseal-chondrodysplasia/