

OBESITY AND OSTEOARTHRITIS - ARE THEY RELATED?

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Introduction

The World Health Organization has declared obesity to be the most important human health problem facing the Western world. Most of us would agree that a similar scenario is found in small animal veterinary practice. Recent literature would suggest that more than 50% of dogs and more than 70% of people are overweight or obese. Osteoarthritis (OA) has also become an increasing concern in human and veterinary medicine. Literature from human medicine would indicate that approximately one quarter of adults have OA and veterinary literature suggests a similar percentage of dogs are affected. Anecdotally, many people believe OA is under diagnosed in small animal veterinary practice. The comorbidity that exists between obesity and osteoarthritis has been established. Reports indicate that 40% of dogs and 31% of people with OA are also overweight.^{1,2} In spite of the knowledge of this comorbidity, the mechanisms by which obesity and OA are related are less clear.

What is Osteoarthritis?

An understanding of OA and the current treatments is relevant to this discussion. Osteoarthritis (OA) can be described simply as a deterioration of a joint associated with pain and dysfunction. In reality OA is a much more complex condition with biochemical, physical and pathological alterations. All of these factors require consideration when approaching treatment. Traditionally the treatment approach has been to palliate painful symptoms. In fact the pathologic changes including bone and soft tissue alterations that result in lameness and clinical signs may not coincide with the degree of pathologic or radiographic change. This makes utilization of multimodal techniques essential for the essential treatment of OA. As obesity contributes to both biomechanical and biochemical changes throughout the body, both need to be considered when attempting to draw a line between obesity and OA. It is not difficult to understand that increased load on joints due to being overweight will have an impact on articular cartilage as well as the periarticular structures. The proinflammatory state induced by an excess of body fat is something that is not considered as frequently and these biochemical changes must be considered when discussing and treating OA.

Biomechanical Factors

It is well established that joints need to be loaded in order to maintain healthy articular cartilage. Too much of a load or too little of a load will result in detrimental changes in cartilage believed to contribute to the development of OA. Both overweight/obese dogs and people have been exhibit alterations in their gait. This alteration in joint kinematics and increased ambulatory load likely contributes to the initiation and progression of OA. Dogs that are overweight/obese produce higher ground reaction forces as well as increased range of motion during the stance phase documenting both increased compressive loads on their joints along with additional strain on the periarticular structures.^{3,4}

Biochemical factors

Obesity has been identified as a risk factor for development of osteoarthritis in people with effects on the weight bearing joints due to the biomechanical factors present well documented. Convincing evidence exists that obesity is also a risk factor when considering non-weight bearing joints leading to the conclusion that systemic factors are also involved.⁵ The concept of 'fat as an organ' has been well discussed and cytokines produced by adipocytes have been implicated in many chronic diseases. Adipocytokines such as leptin and adiponectin have been documented in both human and canine adipocytes.⁶ These cytokines have been shown to have effects on articular cartilage but may also affect the synovial membrane, subchondral bone and infrapatellar fat pad.⁷ In fact, elevation of cartilage degradation biomarkers may be detected in the serum of overweight/obese dogs prior to development of clinical lameness and radiographic signs associated with OA.⁸

Weight Loss – Improved Function? Increased Activity?

The questions of whether or not maintenance of an ideal body weight can reduce the incidence of OA or whether or not weight loss is an effective treatment for OA become very important when discussing this relationship. One study showed that an 8% increase in body weight in dogs resulted in reduced weight bearing as measured by force plate analysis. The same study showed that dogs with radiographic OA show clinical improvement and a measureable increase in peak vertical force after a 3% decrease in body weight.⁴ Two studies have shown that weight loss improved function in dogs with radiographic evidence and clinical lameness associated with hip OA.^{9,10} In terms of reducing the incidence of OA by maintaining an ideal body weight, Kealy et al demonstrated that a 25% reduction in diet delayed the onset of chronic disease, including OA, increased the age at which radiographic sign of OA were detected as well as increased the age when dogs required NSAID treatment for OA. The lifespan of the dogs in the lean control group was also longer.¹¹

Summary

The relationship between obesity and osteoarthritis and the associated mechanisms are becoming increasingly well understood in human medicine. There is an increasing interest in investigating this relationship in veterinary medicine as the impact of weight management in the prevention and treatment of many chronic diseases in small animal practice is great. Weight management and weight loss should be discussed with our clients as an integral part of a wellness plan for all of our patients. Weight management is an important topic of discussion for reducing the incidence of and a treatment for osteoarthritis.

References:

- 1 - Klausner JS, Lund E: State of Pet Health 2012, (2012) in, Vol. Portland, OR, Banfield Pet Hospitals.
- 2- "Prevalence of doctor-diagnosed arthritis and arthritis-attributable activity limitation- United States", 2010-2012. (2013) MMWR Morb Mortal Wkly Rep 62:869-873.

- 3- Brady RB, Sidiropoulos AN, Bennett HJ, et al (2013) "Evaluation of gait-related variables in lean and obese dogs at a trot." *Am J Vet Res* 74:757-762.
- 4- Moreau M, Troncy E, Bichot S, et al. (2010) "Influence of changes in body weight on peak vertical force in osteoarthritic dogs: a possible bias in study outcome." *Vet Surg* 39:43-47.
- 5- Visser AW, Ioan-Facsinay A, de Mutsert R, et al. (2014) "Adiposity and hand osteoarthritis: the Netherlands Epidemiology of Obesity study." *Arthritis Res Ther* 16:R19.
- 6-Eisele I, Wood IS, German AJ, et al. (2005) "Adipokine gene expression in dog adipose tissues and dog white adipocytes differentiated in primary culture." *Horm Metab Res* 37:474-481.
- 7- Richter M, Trzeciak T, Owecki M, et al. (2015) "The role of adipocytokines in the pathogenesis of knee joint osteoarthritis." *International Orthopaedics* 39:1211-1217.
- 8- Yamka RM, Friesen KG, Frantz NZ. (2006) "Identification of Canine Markers Related to Obesity and the Effects of Weight Loss on the Markers of Interest." *International Journal of Applied Research in Veterinary Medicine* 4:282-292.
- 9- Bottcher P, Kluter S, Krastel D, et al. (2007) "Liposuction--removal of giant lipomas for weight loss in a dog with severe hip osteoarthritis." *J Small Anim Pract* 48:46-48.
- 10- Impellizeri JA, Tetrick MA, Muir P. (2000) "Effect of weight reduction on clinical signs of lameness in dogs with hip osteoarthritis." *J Am Vet Med Assoc* 216:1089-1091.
- 11- Kealy RD, Lawler DF, Ballam JM, et al. (2000) "Evaluation of the effect of limited food consumption on radiographic evidence of osteoarthritis in dogs." *J Am Vet Med Assoc* 217:1678-1680.