MANAGING CANINE OSTEOARTHRITIS

Author : Rob Pettitt

Categories : Vets

Date : July 18, 2011

Rob Pettitt discusses approaches to this common problem, and outlines analgesia protocols and the importance of managing obese patients

OSTEOARTHRITIS (OA) in dogs is a common problem, with approximately 20 per cent of the UK population affected.

OA is a process rather than a disease entity and – more importantly – in the dog, it is almost always secondary to some initiating cause, such as cruciate disease, elbow dysplasia and so on. It is a progressive degenerate condition that, once started, will continue for the life of the patient. Patients with OA may have a reduced range of motion, pain within the joint, muscle atrophy and lameness.

Cytologically, OA is classified as “non-inflammatory”, but, in reality, many inflammatory cytokines are involved in the process, such as interleukins and metalloproteinases (MMPs).

Susceptibility to OA is influenced by genetics, age and systemic factors, such as obesity. This provides a predisposition to OA that, when combined with factors affecting joint biomechanics (such as injury, instability and abnormal development), gives rise to clinical OA.

Osteoarthritis involves pathological changes to all tissues within the joint (such as subchondral bone or synovium) and not just the articular cartilage, although the latter is the most important part. Based on experimental studies, such as the Pond – Nuki model of cranial cruciate ligament transection – which will induce osteoarthritis within three weeks – the progression of OA has been well documented.

Biochemical changes occur initially, which lead to swelling and loss of stiffness of the articular cartilage. As a response, the chondrocytes increase their metabolic activity and numbers. Cell clusters form, surrounded by a newly formed matrix, which is a process known as cloning. The final stage is where the chondrocytes are unable to keep up with the repairs and catastrophic failure of the articular cartilage ensues.

In the synovium, during the early stages of OA, there is a mild inflammatory response. Despite the relatively low levels of inflammation, the presence of inflammatory mediators can make the articular cartilage more vulnerable to degeneration. This inflammation increases as the OA progresses, leading to hyperaemic synovium – which has been shown to be a major source of pain. Thickening of the synovium may also reduce range of motion.

The subchondral bone also undergoes changes due to OA. Initially, a loss of bone occurs – underlying the articular cartilage due to altered loading.

The subchondral bone then thickens and becomes sclerotic and is less stiff than normal bone. Bone cysts may also form and are a common late characteristic of OA.

Osteophytes are the main indicator of OA in dogs and are apparent at the insertion of the synovium with the bone. They are influenced by a complex set of growth factors to develop and arise from mesenchymal progenitor cells, which differentiate and undergo endochondral ossification.

Diagnosis

The detection of osteophytes on a radiograph indicates the presence of OA in a joint, but that is insufficient for a diagnosis – both in terms of identifying the inciting cause and also in confirming that joint as the source of the problem. As already discussed, OA is most commonly a secondary disease in the canine patient, so it is important to try to identify the underlying cause. In cases of hip dysplasia, often severely affected joints (Figure 1) may be clinically silent.

A combination of history, clinical examination and further imaging is necessary before appropriate therapy can be commenced.

Management

The aims of treatment are to reduce the severity of the clinical signs, decrease the levels of pain and maintain the quality of life for the patient. Management should be multimodal and combine analgesia, exercise, weight control and physiotherapy, among others. In extreme cases surgery, such as joint replacement, is necessary.

Analgesia

• **NSAIDs**

NSAIDs are the most common analgesic drugs used in managing canine OA, and accounted for an annual cost exceeding US$130m in the US in 2005.

They work, in principle, by inhibiting one or more pathways in the arachidonic acid cascade (prostaglandin formation) at the level of the cyclooxygenase (COX) or lipooxygenase enzymes. NSAIDs also appear to mediate cellular and humoral immune responses, suppressing other inflammatory mediators. These effects are both dose and drug-dependant and the major therapeutic and toxic effects of NSAIDs are associated with this. NSAIDs rapidly palliate the pain associated with OA, although this can sometimes lead to serious and occasionally fatal adverse effects. A systematic review concluded there was strong evidence for the use of some NSAIDs (Sanderson et al, 2009).

NSAIDs work in part by inhibiting COX isoenzymes to varying degrees. Simplistically there are two pathways – COX-1 (constitutive), which is associated with physiological functions, and COX-2 (inducible), which is associated with inflammatory cascades, although this division is over-simplified. Traditional NSAIDs, such as aspirin, carprofen and meloxicam, inhibit both COX-1 and COX-2 to varying degrees. The latter two, however, are described as “COX-2-selective”, meaning they inhibit COX-2 at lower concentrations and so have improved safety profiles. So-called “coxib” NSAIDs (such as robenacoxib, mavacoxib and firocoxib) are highly selective for COX-2, with ratios into the 100s: 1, and so theoretically offer analgesic and anti-inflammatory effects as good as previous NSAIDs without interfering with the homeostatic functions of prostaglandins in the gastrointestinal tract, kidneys and platelets.

Protocols for administrating NSAIDs vary hugely from intermittent “as-needed” therapies to “continuous lifelong” therapy. The benefits of the latter include better control of pain, greater mobility and possibly slowing aspects of the disease process, such as decreased muscle atrophy with increased use and the reduction of nitric acid-induced cell death. This, however, has to be balanced against the potential increased risks of adverse effects and tolerance to the drug. In addition, most owners are not 100 per cent reliable at continual administration of medication. (Innes et al, 2010).

The effects on the metabolism of joint tissues of using NSAIDs long term have been studied and the results are conflicting. The positive effects are small, but may be cumulative over long periods. Certain NSAIDs have been shown to inhibit degradation of cartilage in vitro, and it has been further suggested that there are positive effects on the subchondral bone that may be important in disease modification.

Adverse effects of long-term medication (greater than 28 days) have been reported in a recent review (Innes et al, 2010), which showed there was a relatively low experimental event rate.

Exact determination of the adverse effect rate is difficult given the lack of placebo controls in the published studies. Although modern NSAIDs are deemed safer than the earlier versions, veterinary supervision of long-term therapy is essential and those patients considered at increased risk should be monitored particularly carefully. Owners should receive accurate dosing information and warned of the possible side effects.

The selection of which NSAID to use is expanding, and readers are referred to other publications/ data sheets for the information relating to each drug. Recent developments, such as COX-2-selective drugs, and the first longacting NSAID (mavacoxib) serve to increase the arsenal available to the veterinary surgeon. What may work with one patient with OA may not be as effective in others, so it is worth repeating treatments with a couple of different NSAIDs.

Multimodal usage (combining with drugs from other classes, such as paracetamol) is often off licence and vets should seek “informed consent” before these drugs are administered.

Multimodal approaches stem from recent advances in knowledge about the sensitisation of the central nervous system as a result of constant input of pain signals (Lascelles et al, 2008) and is common in human medicine.

In canine patients, although there is anecdotal clinical experience to support this, there is little published clinical evidence. Caution should be used when trialling multimodal usage, as toxicity information under these circumstances is currently lacking.

- **Paracetamol**

Paracetamol is licensed in the dog at 10mg/kg two to three times daily for somatic pain. Pardale V (paracetamol and codeine) is licensed at 32mg/kg (paracetamol dose), but the authors use it at the 10mg/kg dose. There are other drugs, such as gabapentin and amantadine, which may be used in the management of chronic pain, but are not covered here due to them being off-licence when used in combination or in isolation. Tramadol has not been included, as there is no evidence of its efficacy (or toxicity levels) in dogs.

Omega-3 fatty acids

Increasing dietary supplementation of Omega-3 can enhance the concentration of this fatty acid in tissues and cell membranes, with a corresponding decrease in concentrations of Omega-6, particularly arachidonic acid.

Eicosanoids generated from Omega-3 fatty acids tend to be less potent inducers of inflammation than those generated from arachidonic acid. Canine randomised, controlled, doubleblinded studies demonstrated an increase in the weight bearing of dogs with osteoarthritis, both objectively using force plates and subjectively through owner assessments (Roush et al, 2010).

A further study demonstrated that required carprofen doses decreased significantly faster in dogs fed an Omega-3-supplemented diet than in the control dogs (Fritsch et al, 2010). The proportion of Omega-3 in these trial diets was 3.5 per cent.

Exercise

A review from the human literature demonstrated that undertaking controlled exercise played an important role in moderating the clinical OA signs (Bennell and Hinman, 2011). No similar reviews exist in the veterinary literature, although one study highlighted the effect exercise has on dogs with osteoarthritis (Beraud et al, 2010). It is prudent, when managing arthritic animals, that exercise is controlled; both levels of activity and duration. Short lead walks should be started initially, with a gradual increase over a period of weeks. Rigorous exercise should be avoided when lameness is apparent.

Weight management

A link between obesity and knee and hand OA has been well established in humans, although the exact mechanisms have yet to be fully evaluated.

Current theories include biomechanical overload, but also the biochemical effects of adipokines found in adipose tissue, in particular the role of leptin. Recent meta-analysis showed a five per cent weight loss in obese humans over a 20-week period could significantly reduce selfreporting disabilities in knee OA cases (Christensen et al, 2007).

In dogs, there is one longitudinal study that demonstrated that obesity prevention significantly reduced the prevalence and severity of OA, and also delayed the clinical signs associated with the disease (Kealy et al, 1997). Longevity was also increased, with limit-fed dogs living on average 1.8 years longer.

Weight loss in dogs with OA has also been shown to have a positive effect on clinical signs, both objectively and subjectively, in a number of studies. The veterinary profession has highlighted the scale and significance of obesity in the companion animal population (German, 2006). From the literature, it is apparent that when OA is associated with obese animals, then attempting to return these animals to a normal body condition will optimise joint health and help reduce the clinical signs associated with the OA.

Summary

In summary, OA is a lifelong debilitating condition in all species that requires careful and continuous management.

When dealing with such cases, it is important to educate the owners about what they might realistically expect from their pets. OA is not uniform in progression and the clinical signs (such as lameness) will wax and wane.

Disease management involves a multimodal approach and includes analgesia, weight control, exercise and physiotherapy. Proactive involvement of the owners leads to a greater likelihood of compliance.

Failure to satisfactorily manage OA conservatively may necessitate salvage surgery (such as total joint replacement or arthrodesis) or euthanasia on welfare grounds.

References and further reading

- Bennell K L and Hinman R S (2011). A review of the clinical evidence for exercise in osteoarthritis of the hip and knee, *Journal of Science and Medicine in Sport* **14**: 4-9.
- Beraud R et al (2010). Effect of exercise on kinetic gait analysis of dogs afflicted by osteoarthritis, *Veterinary and Comparative Orthopaedics and Traumatology* **23**: 87-92.
- Christensen R et al (2007). Effect of weight reduction in obese patients diagnosed with knee osteoarthritis: a systematic review and meta-analysis, *Annals of the Rheumatic Diseases* **66**: 433-439.
- Fritsch D A et al (2010). A multicenter study of the effect of dietary supplementation with fish oil omega 3 fatty acids on carprofen dosage in dogs with osteoarthritis, *JAVMA* **236**: 535-539.
- German A J (2006). The growing problem of obesity in dogs and cats, *Journal of Nutrition* **136**: 1,940S-1,946S.
- Innes J F et al (2010). Review of the safety and efficacy of long-term NSAID use in the treatment of canine osteoarthritis, *Veterinary Record* **166**: 226-230.
- Kealy R D et al (1997). Five-year longitudinal study on limited food consumption and development of osteoarthritis in coxofemoral joints of dogs, *JAVMA* **210**: 222.
- Lascelles B D X et al (2008). Amantadine in a multimodal analgesic regimen for alleviation of refractory osteoarthritis pain in dogs, *JAVMA* **22**: 53-59.
- Roush J K et al (2010). Evaluation of the effects of dietary supplementation with fish oil omega 3 fatty acids on weight bearing in dogs with osteoarthritis, *JAVMA* **236**: 67-73.
- Sanderson R O et al (2009). Systematic review of the management of canine osteoarthritis, *Veterinary Record* **164**: 418-424.