SHOULD I DO A TATE OR INJECT STEM CELLS?
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Treatment of a patient with lameness secondary to end-stage osteoarthritis is difficult because to date there is no perfect treatment. For the treatments available many argue about what might be best. The simple answer is that there is no single “best” treatment for all patients. Many factors enter in the equation. For the patient one must consider age, breed/body size, activity level, and concurrent diseases. For the owner one must consider owner goals for the dog and financial/time resources they are willing/able to dedicate to the problem. For the veterinarian one must balance their experiences with the scientific evidence. Perhaps the difficulty with that last sentence is the word “balance”; how many veterinary surgeons truly give equal weight between their opinion and scientific evidence?

Adult stem cells in veterinary medicine can be derived from adipose tissue or from bone marrow. In small animal veterinary medicine stem cells are more commonly collected from adipose tissue but my opinion is that bone marrow-derived cells remain a perfectly reasonable option. In dogs, adipose-derived stem cells (ASC) are usually collected and hold the potential for differentiation into bone, cartilage, adipose, and fibrous tissues. This multipotency is a key component to calling a cell a “stem cell” and is something we, and others, have been able to demonstrate from fat and BM derived cells in the dog. Adipose-derived stem cells also have trophic and anti-inflammatory properties. Because of this the main focus in the veterinary literature has been the treatment of osteoarthritis (OA). In two, prospective, randomized, placebo-controlled studies, dogs with lameness from osteoarthritis improved when treated with the stromal vascular fraction (SVF) as compared to dogs treated with placebo. However, the number of dogs evaluated in these studies was small and only subjective outcome measures (owner and veterinarian opinion) were used. At this point it is important to understand some terminology. Historically, “stem cell therapy” in dogs has been limited to commercial operations (e.g. Vet Stem) that will process fat obtained from a patient, and return a stromal vascular fraction (SVF) preparation of stem cells to the veterinarian for injection. Stem cells are not specifically isolated or cultured. This process has limitations. The patient, with systemic illness, must undergo a general anesthetic episode for surgical collection of fat. Treatment with the SVF includes all nucleated cells harvested from the fat collection. It has been estimated that approximately 1% of these cells are stem cells. The variability in the product is exceptionally high. For example, would you expect the cells from a 10 year old, obese, Labrador retriever that has had OA for its entire life to be similar to a 1 year old Greyhound that will likely never develop OA? Finally, since there is no quality control of the product it may have undesirable effects. For example, cells from donors express high levels of anti-inflammatory cytokines while others express high levels of inflammatory cytokines. Nonetheless, the benefit of treatment with the SVF was measurable and positive in a randomized clinical study. Thus, I believe the SVF has a benefit but I still question if the benefit outweighs the limitations and cost.

Partial and total elbow replacement continues to mature as a surgical procedure for dogs with lameness secondary to osteoarthritis of the elbow. To date, several abstracts, proceeding notes, chapters, and websites are available to describe these techniques, but only two peer-reviewed scientific papers address total elbow replacement in the dog. These papers address what is sometimes referred to as the Iowa State Elbow because that is where is was designed and
tested. However, the implants, the implanting devices (guides) and surgical technique have changed from those reports in an effort to improve the technique and the patient outcomes.

The originally described ISU elbow implants that were used and reported on had an 80% success rate. The limitations were because of several design flaws that predisposed the patient to fracture of the ulna, fracture of the humerus and elbow luxation. Ulnar fracture occurred because the radioulnar implant had an ulnar stem that was difficult to put in and the cutting guides left for a jagged cut that created areas of stress concentration when the triceps pulled on the olecranon. After the report a cutting guide system was developed that utilized a circular cut. This was a vast improvement but the problem of preparing the ulna for the ulnar stem still remained. Most recently this has been addressed by eliminating the ulnar stem altogether or changing the surgical approach to a ulnar osteotomy at the level of the radial head. Fracture of the humerus occurred because the humeral implant had large metal shoulders that required removal of bone in the intercondylar area. This weakened the area and fracture, at the time of surgery, could occur. This was simply addressed by making the shoulders on the implant smaller. Since this change the author has not seen humeral condylar fracture or implant fracture.

In this authors experience lateral elbow luxation is the most common complication. In fact, I would suggest that is represents about 50% of all complications that occur, or about 10% of all surgical cases. Several years ago a cutting guide system was developed that allowed for the center of rotation of the humeral implant to guide the cuts made for the radioulnar implant. This allowed for the two implants to be implanted with very similar centers of rotation, thus increasing stability between the two implants. However, in my experience, lateral luxation continued to be a problem. This cause of this problem was recently identified in a mechanical testing study that showed that the ISU elbow implants only have a small fraction of the stability of the normal elbow after all the ligaments of the elbow have been removed. In effect, it was too nonconstrained. This problem was documented to be present in both translation and in rotation. A design modification to increase resistance between the two implants in shear and rotation demonstrated significantly greater resistance to lateral luxation (manuscript in press Vet Surg 2012). This design change radically alters the articular surface but does not alter the primary method by which the components are implanted. In addition, the design change has capitalized on ingrowth technologies so the radial implant (no longer has an ulnar stem) can be used cementless. An alternative to implant design is to preserve both collateral ligaments during the surgical approach by approaching caudally via an ulnar osteotomy at the level of the radial head. (Personnel communication, N. Fitzpatrick, 2011)

It has been stated that the TATE elbow replacement system has been used in over 100 cases and offers a change of pace. The surgical approach, which is sometimes referred to as minimally invasive, requires an osteotomy of the medial epicondyle. Unfortunately, that surgical approach alone has a report 18% complication rate. A burring frame is attached and much (not all) of the articular surface is removed. The greatest advantage of this system may also be its greatest disadvantage. The two component system is semiconstrained and the components (which are cementless) are put in at the exact same time while the frame is still attached. This allows for the center of rotation of the components to be identical but this is also a limitation because whatever morphologic changes existed in the dog’s stance before surgery will still be present after surgery. In effect, there is very limited ability to straighten a limb with this system. Thus, even with surgical success a mechanical limp may be present. One concern expressed over this system is the multiple revisions that have taken place without public, scientific sharing of the reasons for the changes, what the changes were, and how the changes might impact
success or failure. Since there are no publications addressing successes, or failures, I have no idea if performing a TATE is a good idea or not.

Given the evidence of stem cells or total elbow replacement I would suggest that the use of stem cells has greater evidentiary value. If stem cells were a viable treatment option without prior surgical intervention (i.e. allogeneic stem cells) then this would clearly be the route to choose prior to total joint replacement. One must also consider treatment options in the face of failure. If stem cells are tried and they are ineffective then joint replacement is still a viable option. The alternative treatment order yields a different response.