ELBOW DYSPLASIA: MEDICAL AND SURGICAL TREATMENT
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A. Medical Treatment

Most, if not all, dogs with elbow dysplasia would benefit from lifelong medical management of elbow osteoarthritis (OA). Because veterinary studies evaluating many of these treatments are limited, decisions regarding medical management of OA are often based on clinician preference. However, it is important to be aware of the quality of evidence that supports each of our recommendations and borrow from human literature when appropriate. We will discuss each element of medical management listed below in more detail, but the following serves as a checklist of the components of medical management to consider and discuss with owners of dogs with OA.

Components of Medical Management of OA

<table>
<thead>
<tr>
<th>General Category</th>
<th>Examples</th>
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<tbody>
<tr>
<td>Weight management</td>
<td>Calorie restriction</td>
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<td></td>
<td>Pharmaceuticals: mitratapide, dirlotapide</td>
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<tr>
<td>Exercise moderation</td>
<td>Low impact activity: swimming, walking</td>
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<td>NSAI Ds</td>
<td>Either intermittent or daily</td>
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<td>Other pain-relievers</td>
<td>Tramadol, gabapentin</td>
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<tr>
<td>Nutraceuticals, functional food</td>
<td>Chondroitin sulfate, glucosamine sulfate, glucosamine hydrochloride, essential fatty acids</td>
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B. Surgical Treatment

Elbow arthroscopy is an important component of the diagnostic and treatment plan of most forms of elbow dysplasia. Arthroscopy has replaced arthrotomy in most cases due to the reduced patient morbidity, improved visualization, and ease of bilateral elbow treatment associated with arthroscopy. Elbow arthroscopy is performed from the medial aspect of the joint. Structures evaluated during elbow arthroscopy include a portion of the anconeal process, the trochlear notch, the medial and lateral portions of the coronoid process, the radial head, and the humeral condyle. The cartilage on each of these surfaces is evaluated and graded.

UAP

In most cases of UAP and particularly in those that are chronic, the anconeal process is surgically excised via a caudolateral approach to the elbow joint. Surgical reattachment of the UAP with lag screws or K-wires via a lateral approach to the elbow may be considered in dogs less than 24 weeks old with normal confirmation of the trochlear
notch. Proximal ulnar osteotomy (PUO) may be performed to restore joint congruity, relying on the triceps brachii muscle to pull the ulna proximally during weight bearing. Restoration of joint congruity promotes anconeal process union in young dogs. Alternatively, PUO may be combined with reattachment of the UAP. Although the anconeal process is too large and caudally positioned to be removed arthroscopically, dogs with UAP often undergo elbow arthroscopy at the time of surgery to address the UAP in order to inspect the joint for and treat any concurrent components of elbow dysplasia. Objective evaluation of the outcome of various surgical techniques to treat UAP is plagued by the same limitations in study design that characterize studies evaluating treatment of medial compartment disease, including small study populations and reliance on subjective outcome measures.

**Medial Compartment Disease**

1. **Arthroscopic fragment removal and subtotal coronoidectomy**
   Most authors agree that removal of a fragmented medial coronoid process is beneficial for reducing pain and improving limb function, at least in the short- to medium-term time frame. The rationale for subtotal coronoidectomy (removal of more of the medial coronoid process than just the fragment) is based on the study by Danielson et al. (2006). This study identified changes in the subchondral bone of the medial portion of the coronoid process (osteocyte loss, microcracks) even in the absence of visible cartilage fissures. Routine use of CT followed by arthroscopy in dogs with elbow dysplasia has confirmed these findings. CT and arthroscopy findings are used to determine how much of the medial portion of the coronoid process should be removed. Specifically, indications for subtotal coronoidectomy in addition to fragment removal include pathologic changes of the coronoid process on CT, large fragments that involve most of the coronoid process, cartilage disease of the humeral trochlea (to reduce humeroulnar contact), and radioulnar incongruity at the apex of the coronoid process (to improve congruity).

2. **Arthroscopic treatment of humeral OCD**
   Arthroscopic treatment of humeral OCD involves removal of the cartilage flap followed by treatment of the subchondral bone defect to promote healing of the defect with fibrocartilage. Techniques used to stimulate healing of the subchondral bone defect include curettage, abrasion with a motorized burr, forage with subchondral drilling, and microfracture. All of these techniques aim to access the blood supply, and therefore mesenchymal cells and growth factors, deep to the bone. If performed too aggressively, curettage or abrasion may result in excess removal of cartilage and subchondral bone. Subchondral drilling (with fine K-wires or microdrill burrs) may be superior to microfracture since some evidence shows that microfracture tends to compact the bone around the holes made by the micropick. However, subchondral drilling is sometimes impractical within the small working space of the canine elbow.

3. **Treatment of incongruity: Proximal Ulnar Osteotomy (PUO)**
PUO is used to treat radioulnar incongruity. Restoring or improving congruity decreases loading of the medial compartment of the joint. In the case of medial compartment disease, the ulna is tall with respect to the radius, so the PUO is technically an ostectomy (rather than an osteotomy). The ostectomy is made proximal to the interosseous ligament, creating a gap at least equal to the degree of incongruity. Weight bearing forces should realign the joint surfaces by pushing the ulna distally. Techniques to reduce the risk of caudal tipping of the proximal ulnar segment include orienting the ostectomy at an oblique angle and placing an intramedullary pin in the ulna.

4. Sliding Humeral Osteotomy (SHO)
Sliding humeral osteotomy was developed following the discovery that mechanical load in the elbow joint is distributed more equally between the radius and ulna than previously thought. In cases of radioulnar incongruity, the load is concentrated on the medial portion of the coronoid process. The SHO involves an osteotomy of the humeral shaft, followed by lateral translation of the proximal segment, and fixation of the bone in the new configuration with a specific bone plate and locking screws. By shifting the mechanical axis of the humerus, load applied to the ulna is reduced. Clinically, this procedure has been performed in cases with substantial cartilage loss in the medial compartment but intact cartilage in the lateral compartment (as determined by arthroscopy). Early complications due to implant failure have been reduced due to improvements in implant design, but studies evaluating the efficacy of the procedure are lacking.

5. Total Elbow Replacement (TER)
Indications for total elbow replacement include end-stage elbow osteoarthritis unresponsive to medical management. Although elbow OA often results from elbow dysplasia, it may also develop secondary to articular fractures, elbow luxation, and angular limb deformity. Contraindications for elbow replacement include active infection, chronic elbow luxation, severe malunion, neurologic dysfunction, and skeletally immature dogs.

Two total elbow replacement systems are commercially available, the Iowa State system and the TATE Elbow system (both made by the same manufacturer). Both systems use unlinked, semiconstrained two-component designs. This means that each system has a humeral component and a radioulnar component, which are not permanently hinged to each other. There are several differences between the implants and surgical technique of these systems that are beyond the scope of this lecture. Both systems have shown some promising results, but complications are severe when they occur (elbow luxation, humeral fracture, ulnar fracture, infection). The impact of these complications is particularly devastating given the absence of effective revision options; amputation is often not an option when elbow disease is bilateral, and limb function following elbow arthrodesis should be considered marginal at best. Owners considering
total elbow replacement must be counseled on alternative treatments, realistic expectations, and potential complications.

6. Canine Unicompartmental Elbow (CUE) Arthroplasty
Canine Unicompartmental Elbow arthroplasty is a partial joint replacement or joint resurfacing technique. Unlike total joint replacement, the CUE system replaces the humeral and ulnar surfaces of only the medial compartment of the elbow. Thus, candidates for this procedure are dogs with disease confined to the medial compartment. The CUE consists of a small humeral component that fits into the trochlea and a small ulnar component that fits into the medial portion of the coronoid process. Theoretical advantages of the CUE compared to TER are maintaining more physiologic load transmission and joint kinematics and preservation of anatomic joint stabilizers by less invasive soft tissue dissection, while still providing options for revision (subtotal coronoidectomy, SHO, TER). However, data on load transmission through the canine elbow after CUE are not yet available, and clinical reports of outcome and complications are in progress but have not yet been published.

C. Prognosis
A summary of the studies evaluating surgical treatment of medial compartment disease in dogs found improvement in an average of 85% of cases. Despite this seemingly encouraging statistic, few dogs, if any, have lifelong resolution of lameness and most, if not all, would benefit from lifelong medical management of elbow osteoarthritis. In addition, there are several obstacles to generating valuable clinical data on the treatment of elbow dysplasia in dogs, and as a result, the quality of evidence presented in the current veterinary literature must be regarded as weak at best.

D. References


