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ANTEBRACHIAL GROWTH DEFORMITIES: Closing Wedge Osteotomies And T-Plating Or Circular Fixator?

Bernard Paré, DVM, DACVS, Department of Surgery



Bernard Paré

Antebrachial growth deformities (AGD) are the most common malformations in dogs. Various causes for AGD have been described, including trauma to the antebrachial physes, chondrodystrophy, genetically induced deformities, metabolic disease, and unbalanced nutrition. Growth deformities are characterized by a combination of antebrachial length deficit, angular and rotational malalignment, elbow incongruity (EI), and carpal subluxation. Secondary effects may include osteoarthritis (OA) of the elbow and carpal joints. Further, EI has been associated with the occurrence of fragmented medial coronoid process (FCP) and ununited anconeal process (UAP). Clinically, AGD will compromise limb function and cosmesis. The reduced function is characterized by lameness because of a combination of joint pain, decreased range of motion, and antebrachial length deficit. Treatment of AGD is directed at correcting the complexity of malalignment, length deficit, and joint function and at prevention of secondary degenerative changes.

Circular External Skeletal Fixator (CESF) Correction

In a 2005 study of 34 dogs, no differences were found between dogs treated with the closing wedge technique or the hinge and- motor CESF for any of the variables investigated. The treatment duration was 6.3 +/- 1.5 weeks, with a follow-up of 17 +/- 12 weeks. The most common complication was wire tract infection, which occurred in 20 dogs (59%). Breakage of transosseus wires was always associated with external trauma to the CESF.

After treatment, function and cosmesis had improved significantly. Function was determined to be normal in 20 dogs (60%), whereas 14 dogs (40%) had grade 1 lameness. Lameness could be attributed to the elbow joint in 5 dogs (35%), to the carpal joint in 2 dogs (15%), and to a combination of the elbow and carpal joints in 7 dogs (50%). An FCP had been removed in 5

dogs with elbow joint lameness (60%). Cosmesis was restored in 22 dogs (65%), whereas 12 dogs (35%) had grade 1 deformity and 7 of these dogs (58%) had carpal valgus despite correction of the angles of deformity, indicative of malformation within the carpus.

Although dynamic correction of rotational deformities is possible, this requires an elaborate frame design, and the character and nature of dogs do not make this a feasible option. In view of this, in the same 2005 study, correction of rotational deformity was performed acutely during surgery. Correction of angular deformities and limb lengthening were executed successfully, using a closing wedge technique or dynamic correction with the hinge and motor configuration.

In the same 2005 study, the hinge and motor configuration had the advantage of dynamic correction of the angular deformity, but its size restricted its use in smaller dogs. Another problem, especially in caudal subluxation of the carpus, was in assessing the ability of the antebrachial flexor tendons and muscles to adapt to the strain put on these structures during dynamic correction of the deformity. The major concern was relative flexor tendon contracture, occurring before



Circular External Skeletal Fixator

continued
on page 3



SEIZURES 101:

What Your Staff Should Know

Mimi Noonan, DVM, DACVIM, Department of Internal Medicine



Mimi Noonan

A seizure is a terrifying thing to watch. Most people think a seizing patient is dying. The patient becomes unreachable, as if in another world, and the overwhelming fear is that he won't return.

For a veterinary professional, it is during these moments of profound fear and helplessness that you can have the most positive impact on your clients. By learning a few principles about seizures, you can help the patient and address the owner's fears and questions.

PRINCIPLE 1: Most seizures are short, so stay calm.

It is rarely necessary to panic and rush the pet into the hospital. Ask the owner what time the seizure began (if you ask how long the seizure has been going on, he will always overestimate, but he often will remember the actual time). Wait until the seizure is over before picking up the pet, unless the seizure has been going on for more than 10 minutes.

PRINCIPLE 2: Overheating is the biggest danger to the seizing patient.

This is especially true in overweight pets, and unfortunately these are the hardest ones to move. If a pet is seizing outdoors on a hot day, even a short seizure can become dangerous. Every effort must be made to cool the pet. Usually, moving him into an air-conditioned house is sufficient. If the seizure is prolonged, a cool bath will help.

PRINCIPLE 3: Seizures beget seizures.

Seizures are caused by aberrant electrical activity in the brain and the electrical activity often has not completely calmed when the visible signs of seizures subside. The brain makes every effort to calm this activity, but it is often unsuccessful. It is, therefore, most common to have a second seizure within a few minutes or hours of the first. You should be prepared, and you should prepare the owner for a second seizure. Usually if the pet has gone 24 hours since the last seizure, the brain has likely been successful in calming the electrical activity.

PRINCIPLE 4: Seizures occur more commonly in times of stress.

Any change in the pet's routine may precipitate seizures. A nervous pet may have a seizure during or after his yearly veterinary visit and be fine for the rest of the year. A pet who has a "great day" at the park or playing with houseguests may seize that evening or the next day. This is particularly frustrating to owners, especially when it happens during a dinner party. Often this can be avoided by altering medication schedules before the change in the pet's routine occurs.

PRINCIPLE 5: Oral antiepileptic drugs take time to work.

Owners hope that the nightmare of seizures is over after they have started epilepsy medications. On the contrary, phenobarbital may take two weeks to have a full therapeutic effect, and potassium bromide as long as four months. It is crucial that owners not become discouraged during this time. You may need to remind them that the medications take time to work every time a seizure occurs. Additionally, there is no benefit to an owner giving an extra dose of medication at the time of a seizure.

PRINCIPLE 6: Most seizing dogs are epileptics, most seizing cats are not.

Calling a seizing pet epileptic implies that there is not an insidious underlying cause for the seizures, such as encephalitis or a brain tumor. Diagnostics steps must be taken to prove this. However, studies have been done that suggest that somewhere in the range of 90% of dogs who have a seizure do not have a life threatening underlying disease process. Studies in cats are not so positive; less than 10% of cats with seizures have a non-progressive etiology. Cats who have seizures are more worrisome than dogs.

PRINCIPLE 7: Epilepsy is manageable, but not curable.

Even with antiepileptic drugs, breakthrough seizures will inevitably occur in epileptic patients. The goal of therapy should be to reduce seizures to a manageable level, while maintaining a good quality of life. It is rare that seizure control can not be achieved, sometimes with the help of a specialist. With care and monitoring, epileptic dogs generally live long, full lives.

PRINCIPLE 8: Epilepsy medication is different in pets than in people.

Potassium bromide, which has been very successful for use in pets, is rarely used in people. The bromide side effects of slurred speech and acne like breakouts that plague human epileptics are not a worry for pets. Likewise, dilantin, which has been widely used for people, can cause an irreversible, fatal liver disease in dogs.

PRINCIPLE 9: Epilepsy requires monitoring.

An owner should be taught that medications have side effects and epileptic patients require lifetime monitoring. A pet on phenobarbital should be checked 10 days after initiating therapy until a therapeutic level has been achieved, then every three months for the first year. After that, twice yearly CBCs and Chemistry profiles as well as phenobarbital levels should be done. Because of potassium bromide's long half-life, it takes as long as three weeks to get halfway to the therapeutic level, so blood should be drawn three weeks into therapy. The blood level at this point should be one half of your goal therapeutic dose, if it is not, adjust accordingly. After achieving therapeutic levels, the monitoring is basically the same as with phenobarbital. Make sure the owners know when they should come in again. Don't wait for a cluster of seizures to see the pet again.

PRINCIPLE 10: Epilepsy drugs can be quirky in some patients.

Owners expect pets to be quieter than usual on phenobarbital. Paradoxically, many are hyperactive. Fortunately, this usually only lasts a couple of weeks. Some owners mistake this hyperactivity and behavior change as a sign of a brain tumor, and need reassurance from you. Most dogs on phenobarbital will drink, eat and urinate more. Some gain large amounts of weight because of the excessive appetite. Phenobarbital can also rarely cause an allergic skin reaction. Potassium bromide will almost always make a pet vomit if given on an empty stomach. Owners should be instructed to give it with food. If vomiting continues to be a problem, give the medication with a tablespoon of yogurt or cottage cheese.

Seizing Patients Protocol

1 Protect yourself and the owner. Unless the pet is in immediate danger of overheating, or has been seizing for a prolonged period of time, let him finish his seizure before attempting to move him.

2 Move the pet to a safe area on the floor to assess him. Most owners relish the opportunity to be out of eyesight of their seizing pet. Take the pet to the back and put him on the floor to assess him. (He will flail off the table!) If the pet is a dog, put a wire cage muzzle on him if possible. This will allow him to vomit or salivate safely, but keep him from biting you when he awakens and is frightened.

3 Reassure the owner that the pet is being cared for and to get a history. Find out if this is the pet's first seizure, when it began, if the pet is diabetic or on any medications, or could have gotten into anything.

4 Take the pet's temperature, heart rate and respirations. If the pet's temperature is above 104°F, you should begin cooling him. Often wetting the ears and paws with cool water or alcohol will suffice. If the temp is greater than 106°F, a cool bath is likely necessary. Only cool the pet until the temp goes down to 102°F, the temp will continue to lower on its own after that.

5 Get a small amount of blood to check a blood sugar. On a dog, you can usually get enough blood from a toenail. On a cat, you will need to draw from a vein. If the pet's blood sugar is below 60mg/dl, you need to get sugar into him.

6 If the violent thrashing continues for more than 10 minutes, you will need to give some medications to stop the seizure. Valium can be given rectally at a dose of 0.5 mg/kg. If a pet is on phenobarbital, this dose should be doubled. The valium can be repeated if necessary. Draw up the injectable valium and deliver it rectally through a red rubber or tom cat catheter.

7 Place an IV catheter if the pet has had a prolonged seizure, and may require hospitalization or additional medications. It may not be necessary, but it can't hurt to have a catheter ready.

8 Give the pet some quiet time to allow him to get his bearings. Wait a bit before bringing the pet back to the owner, or doing an extensive exam. The pet may be aggressive for several minutes after a seizure so be careful when handling him. Avoid the temptation to get a look at that tongue laceration!

9 Prepare for another seizure. If a second seizure occurs, follow the same protocol, but start the rectal valium before ten minutes has passed.

Deformities continued from 1

realignment of the antebrachioacarpal joint was accomplished, leading to carpal flexion, abnormal weight bearing, and possibly joint damage. Acute correction of the antebrachioacarpal joint angles should be considered in treating severe caudal carpal subluxation with a restricted ability to extend the carpus.

The major disadvantage of traditional external fixators and bone plates in comparison with CESF is the inability of these methods to correct antebrachial length deficits and EI dynamically. Nevertheless, angular deformities have been corrected successfully using these methods with comparable results of angular realignment as we found.

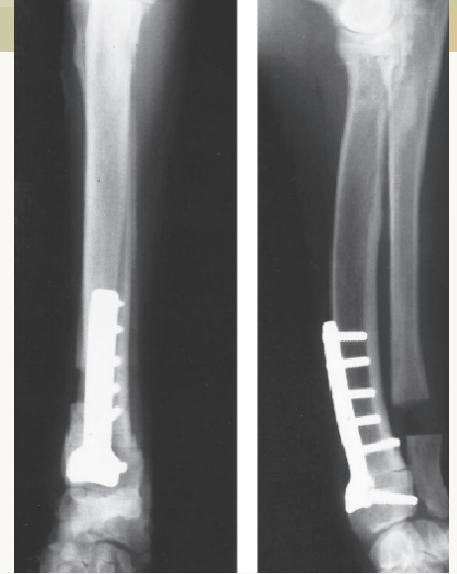
Based on studies, the remaining antebrachial length deficits had a predictable negative effect on the cosmetic appearance, but not on the final function. This may be explained by the ability of the animal to compensate for length deficits of up to 15% by extending the shoulder and elbow joint.

T-plate Fixation of Distal Radial Closing Wedge Osteotomies:

The major advantage of T-plate fixation, as indicated in a 2000 study of 18 patients, is the very low frequency of complications. Only 1 dog needed an additional treatment or surgical procedure (plate removal). Other advantages of T-plate fixation include: the lack of required aftercare by the owner except for restriction of the dog's activity, rapid bone healing, and in most cases, the need for only one surgical procedure.

Previously reported complications with external skeletal fixation included: fixation pin loosening, pin tract sepsis, delayed union, and osteomyelitis. In one study using external skeletal fixation to stabilize an oblique radial osteotomy, 3 of 18 dogs experienced pin tract infection, while an additional 3 dogs experienced generalized osteomyelitis and the need for a second surgical procedure. External skeletal fixation also requires owner aftercare, which includes daily evaluation of fixator security, monitoring for soft tissue ulceration or pin-tract sepsis, frequent cleaning, and changes of fixator wound dressings.

In the 2000 Closing Wedge T-plate study, the most common surgical complication was decreased antebrachioacarpal joint range of motion in 8 limbs. The amount of antebrachioacarpal flexion was observed to be decreased by approximately 40 to 90



T-plate Fixation

degrees in these 8 limbs.

Decreased antebrachioacarpal range of motion, however, also is likely to occur with external skeletal fixation, but this point was not discussed in other studies. Nevertheless, this decrease in antebrachioacarpal joint flexion did not appear to impair function or cosmetic appearance.

Bone plating does not, however, allow for adjustments in alignment after surgery, as is the case with external skeletal fixation; therefore, intraoperative assessment of the amount of correction needed, based on the center of rotation at the antebrachioacarpal joint, must be precise to obtain accurate limb alignment. If significant limb shortening exists, a reverse wedge osteotomy could be used to maintain limb length.

In the same T-Plate 2000 study of 18 dogs, further long-term follow-up evaluation was obtained by owner telephone interview at an average of 4.5 years after surgery (range, 2.5 to 8.5 years) in 9 dogs, with the remaining dogs lost to follow-up. 7 of these dogs were assessed to have a lameness grade of 0, the remaining two dogs were assessed to have a lameness grade of 1. The cosmetic appearance of 11 limbs in these 9 dogs also was evaluated at that time. All of the limbs were rated as either excellent or good, with 8 of the 11 rated as excellent in cosmetic appearance.

In my experience, to prevent relative flexor tendon contracture, most cases should not be provided with antebrachial lengthening, and more than 90% of these antebrachial deformities can be corrected with the combination of a closing wedge osteotomy stabilized with a T-Plate. Because of the stated advantages, safety and high success rate of this technique, this is usually the recommended approach for my patients.



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VSC Team

Help me welcome **Dr. Tiffany Leach**, **Dr. Edward Payne** and **Dr. Laura Gritiuć** to our rapidly growing team.

Dr. Tiffany Leach is excited to join the VSC family. She recently completed her oncology residency at Purdue University and is the newest member of our oncology team. She received her DVM from Kansas State University and has interned with VCA Aurora/Berwyn. She finds her job very rewarding and states that she, "cannot think of a better profession that allows her to connect and build strong bonds with people and their pets".

As an addition to our critical care team, **Dr. Edward Payne**, states that he "thrives on the high pressures that come with critical care medicine".

Dr. Payne comes to us from South Florida where he completed his residency in critical care at Veterinary Specialists of South Florida. He received his DVM and completed his internship at Michigan State University.

Dr. Laura Gritiuć is not new to the VSC family, in fact she is a long-time member. She started with us nine years ago as a technician in our emergency and surgery departments. She received her DVM stateside in 2010 and completed her internship at VCA Aurora. She now returns to us as our new emergency and critical care doctor. Welcome back Dr. Gritiuć!



Tiffany Leach



Edward Payne



Laura Gritiuć

Please join us in welcoming our newest staff members. We are confident that their experience and expertise will complement the wide array of services that we currently offer. Please contact me if you would like to meet with any of our doctors or if there is anything I can do to help facilitate your referral needs.

Best Wishes...
Kim Perroy, CVT
Referral Director
847-459-7535 (ext. 323)

Excellent Medicine with HEART, MIND and SOUL