The ADVOCATE

News from the Orthopedic Foundation for Animals Inc., a not-for-profit organization *Volume 1, Issue 3*

Examining Elbow Dysplasia

Elbow dysplasia can be an extremely debilitating disorder for which there are no satisfactory treatments. Prevention, through selective breeding, is the best means of management.

What's inside

By Janet L. Rettenmaier-Heath, D.V.M., M.S.
Associate Director

Elbow dysplasia has been found in 78 breeds evaluated by the Orthopedic Foundation for Animals, which opened its ED database in 1990. The incidence of elbow dysplasia in these breeds ranged from 1.2 to 47.9 percent of the evaluated dogs.

Elbow dysplasia can lead to lameness or abnormal gait, but a number of affected dogs show no obvious clinical manifestations. Three — possibly four — factors produce elbow dysplasia, either singularly or in any combination.

Elbow dysplasia can be extremely debilitating, but there is no satisfactory medical protocol or surgical procedure that can significantly alter the progression of the disorder or cure it. This makes it increasingly important to reduce the incidence of the disease through selective breeding, which has been shown to reduce its incidence.

The terminology of elbow dysplasia (ED) was introduced in 1961 to describe a generalized osteoarthrosis (OA) of the elbow reported in association with an ununited anconeal process (UAP). A report followed that revealed the same OA without the UAP. Over time, fragmentation of the medial coronoid process (FCP) of the ulna and osteochondrosis dissecans (OCD) of the humeral condyle also were described with this generalized elbow arthritis. These three components are the currently-accepted entities comprising elbow dysplasia.

Another entity that has been theorized as a component of elbow dysplasia, although not uniformly accepted, is the ununited medial humeral epicondyle (a term introduced to describe the lack of fusion of the caudal part of the medial humeral epicondyle). (Figs 1 & 2)

(continued on page 2)

For More Information

Applications or more information on OFA registries and databases are available by calling (573) 442-0418, faxing (573) 875-5073 or writing the Orthopedic Foundation for Animals, 2300 Nifong Boulevard, Columbia, Mo. 65201-3856. Information also is available at the OFA website, http://www.offa.org.

The ADVOCATE

Examining Elbow Dysplasia

(continued from page 1)

A recent case report documented that the histopathologic findings were similar to those observed with chronic fragmented coronoid process. Another term for this abnormality is avulsion of the flexor tendons.

UAP, FCP and OCD may be present singularly or in any combination. It has been reported that FCP with OCD can occur with a frequency as high as 37 percent . With such a high frequency the question arises whether the second lesion is a result of the first lesion in contrast to the two lesions being present as separate entities. Certain breeds tend to be affected with a particular entity more frequently than the other components, which lends support to the heritability of the disorder.

Etiology

The exact mechanism of these abnormalities has not been clearly defined.

There are two different theories for the resulting lesions. The first theory, proposed by Olsson, was that all three disorders are manifestations of osteochondrosis. Osteochondrosis is a disturbance of endochondral ossification, which is the formation of bone through the ossification of cartilage. In the area of the abnormality, there is a thickening of the cartilage due to deprivation of nutrients supplied to the chondrocytes by diffusion from the synovial fluid. The cells at the bottom of the thickened area do not receive adequate nutrition and become necrotic, hence the cartilage in this area will not be attached to the underlying bone. Movement of the bones in the joint provide the forces necessary to break this thickened area free, forming a cartilage flap or a complete full-thickness cartilaginous defect.

Figure 1. Extreme flexed lateral radiographic projection of the elbow joint. The ununited medial humeral epicondyle is at the point of the arrow. The area from which it was displaced is located on the caudal aspect of the humerus. It can be seen as a concave, roughened area.

The Advocate

Published by the Orthopedic Foundation for Animals Inc. to inform and educate veterinarians, veterinary technologists, breeders and owners on advances in animal health and the services of OFA.

Editor

Janet L. Rettenmaier-Heath, D.V.M., M.S.

Figure 2. Craniocaudal radiographic projection of the elbow of the same dog in Fig. 1. The ununited medial humeral epicondyle is at the point of the arrow.

The movement of the bony or cartilaginous fragments prevents healing of the exposed subchondral bone. Pain resulting in lameness, due to inflamed nerve endings in the subchondral bone, may persist or may diminish with time. The fragments serve as a constant irritant, exacerbating lameness and the progression of arthritic changes. This theory was supported by the different components of elbow dysplasia present in the elbows of the same animal.

The second theory, proposed by Wind, is of joint incongruity as a primary cause of the fragmentation or resulting lack of fusion (ununited). Congruency is important in the elbow joint because three bones must fit together smoothly to allow for a gliding movement in flexion and extension as well as internal and external rotation.

The entire ulnar trochlear notch is in close contact with the articular cartilage of the olecranon fossa and the humeral trochlea which articulates with both the radius and the ulna. Any asynchronous growth of the radius and ulna or insufficient development of the ulnar trochlear notch would result in loading forces in the area of the anconeal process and or the coronoid process. It has been proposed, in two different studies, that these separate components are entirely different disease entities since inheritance is independent.

"A number of affected dogs show no obvious clinical manifestations"

Presentation

A number of affected dogs show no obvious clinical manifestations of the disorder. Some affected dogs may be clinically lame or have an abnormal gait. In dogs that are clinically lame, varying degrees of lameness maybe exhibited and exacerbation with activity is seen. Gait abnormality usually is present in dogs with bilateral disease, unless one elbow is worse than the other, making a unilateral lameness evident.

Affected limbs are usually rotated inward with elbows rotated outward. Manipulation of the elbow will reveal a decrease in range of motion. Crepitation, joint effusion, joint capsule thickening and muscle atrophy are variable. This variability is the result of the tremendous range of the abnormality even within a single entity.

The radiographic signs of ED and the clinical presentation do not necessarily correlate directly. A dog may have significant radiographic changes and not be clinically lame. In one study, dogs were evaluated when an acute lameness was present, but no radiographic changes were seen at this time. These same dogs were evaluated at a later date when the clinical lameness had resolved, but radiographic signs of ED were now seen.

This resolution in lameness with a progression of degenerative changes can be attributed to pain in the acute phase of the disease. As healing occurred, the lameness resolved. The damage persisted and, being consistent with the chronic progressive nature of arthritis, resulted in the subsequent radiographic changes.

Diagnosis

In the young dog with lameness from elbow dysplasia, diagnosis is made from typical clinical signs and standard radiographic evaluation. For diagnosis of aa clinically lame patient, views should include a lateral, a craniocaudal and a flexed lateral of the elbow joint. The radiographic appearance is characterized by incongruity and or degenerative changes.

Figure 3. Extreme flexed lateral radiographic projection of the elbow joint. The ununited anconeal process is completely separated from the ulna by the line at the point of the arrow.

Figure 4. Extreme flexed lateral radiographic projection of the elbow joint. A partially fused anconeal process is evident. The anconeal process is fused caudally and the line at the point of the arrow is the area where fusion failed to occur.

The anconeal process may not fuse to the diaphysis of the ulna until 4 to 5 months of age, so a diagnosis of UAP prior to 4 to 5 months of age is premature. No studies have been conducted for the giant breeds to determine an age range; this age range maybe even older in the giant breeds. The usual age of presentation with clinical signs is 6 to 12 months, but affected dogs may not be clinically lame until much older.

UAP is bilateral in 20 to 35 percent of affected dogs. Males are more frequently affected than females, potentially because of a more rapid growth rate and a greater over-all size.

The most significant radiographic sign of UAP is the appearance of a radiolucent line of separation between the olecranon and the anconeal process. (Fig.3) This line may be present in varying degrees since the anconeal process can actually be partially fused. (Fig. 4)

(continued on page 4)

Figure 5. Extreme flexed lateral radiographic projection of the elbow joint. Although not typically evident via radiographic examination, the arrow marks the line of separation of a fragmented medial coronoid process. A small, triangular, radiodense fragment can be seen adjacent to the line of separation.

It is generally a matter of time before the animal becomes clinically lame from elbow dysplasia.

(Continued from page 3)

It is important to obtain a lateral radiograph of the elbow in extreme flexion. If not flexed, the distal, caudal aspect of the medial epicondyle of the humerus is superimposed on the anconeal process, which can be confused with a separation line.

As the disease progresses, sclerosis can be seen along the margins of separation. Degenerative changes subsequently appear at 7 to 8 months of age.

The fragmented coronoid process occurs at 4 to 10 months of age. Unlike a UAP, an FCP may not be visible radiographically. (Figs. 5 & 6) Definitive radiographic identification of FCP often is not possible because of super-imposition of the radial head over the medial coronoid process. In addition, the central radiographic beam rarely intersects the cleavage line in a parallel manner.

The diagnosis of the FCP is typically from the secondary degenerative changes that result from the abnormality.(Fig. 7) These are seen as early as 7 to 8 months of age but may not be evident until maturity. These are osteophytes located on the proximal and lateral aspects of the anconeal process. Similar changes on the medial humeral epicondyle and medial aspects of the joint develop as the disorder progresses. Sclerosis between the proximal radius and ulna and/or an increased humeroradial joint space maybe seen on a lateral projection.

The primary radiographic sign of OCD is common to all locations. There is evidence of a subchondral bone defect that causes a flattening or concavity of the articular surface. In the elbow OCD is diagnosed by visualization of either a subchondral bone defect or cartilage flap on the medial humeral condyle. (Fig. 8) This defect may have a sclerotic margin.

The cartilage flap may become calcified or contain a piece of subchondral bone facilitating recognition radiographically as a "joint mouse."

Figure 7. Craniocaudal radiographic projection of the elbow joint. A large osteophyte is seen (arrow) as the result of FCP.

A calcified cartilaginous flap maybe seen radiographically as a thin, linear, mineral opacity covering the defect. The disease occurs between 4 to 10 months of age. OCD can affect multiple joints (elbow, shoulder, stifle, hock) and is commonly bilateral. If a dog is lame and elbow dysplasia is a suspected diagnosis, then the contralateral elbow should be radiographed as well. A craniocaudal projection or a slightly oblique lateral craniocaudal projection is necessary to visualize a lesion in the elbow. (Fig. 9)

In general, the amount of arthritic changes that result from elbow dysplasia parallels the amount of joint instability created by the abnormality. Since the UAP is typically the most unstable, it is likewise associated with the most degenerative changes and subsequently the worse prognosis in reference to debilitation. The FCP is less unstable.

The osteochondrosis lesions may not create gross instability but are associated with incongruency and inflammation that

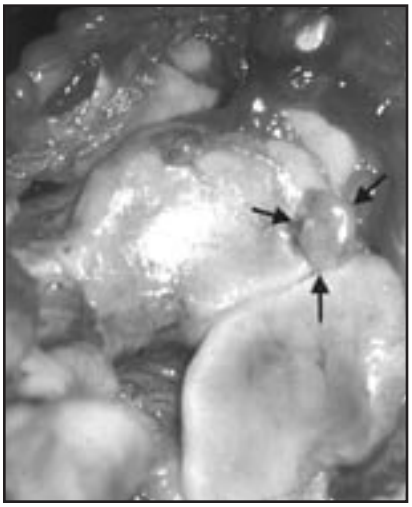


Figure 6. A gross tissue specimen showing the articular surface of the ulna (right) and the radius (left). The arrows emphasize a fragmented medial coronoid process.

Figure 8. A gross tissue specimen of the condyles of the humerus. An OCD lesion resulted in a large cartilaginous defect which exposed the subchondral bone.

Figure 9. Slightly oblique craniocaudal radiographic project of the elbow joint. The arrows emphasize a radiolucent subchondral bone defect from osteochondrosis.

would result in degenerative changes. Fissures in the cartilage or slightly irregular articular margins would be the least abnormal. (Figs. 10 & 11) These changes are not evident radiographically, but the resulting degenerative changes would eventually become evident radiographically.

At this time there have been no scientific studies that have correlated the amount of degenerative change with the amount of dysfunction or prognosis. With the chronic progressive nature of arthritis, it is generally a matter of time before the animal becomes clinically lame from the disorder.

Therapy

Treatment for elbow dysplasia will vary according to the individual case. Factors to be considered are the present amount of degenerative joint disease, age of the patient and degree of lameness. Typically all immature dogs showing lameness referable to FCP, OCD or a UAP are surgical candidates. Mature dogs with mild to moderate arthritic changes and a component of instability also may be considered for surgery.

Removal of the unstable component may provide for some decrease in pain. Dogs with pain from severe degenerative changes, but in which the joint is stable, are not considered surgical candidates because surgery may disrupt stability and aggravate the problem. Surgery is recommended to facilitate healing of the cartilagenous defect and to remove the loose fragments.

Depending on the component of elbow dysplasia and the amount of abnormality present at the time of surgery, owners should be aware that arthritis is a progressive disorder and improvement may be seen, but normality probably will not be achieved. Medical and surgical management is often unrewarding. Fewer than 50 percent of the dogs treated medically and fewer than 60 percent of the dogs treated surgically (for FCP) had a satisfactory long-term recovery.

The rate and extent of arthritic changes are variable. Elbow dysplasia can be a crippling disorder. The degree of osteoarthritis may be severe enough that by the age of 2 years clinical signs are evident and the use of analgesics are indicated for pain relief.

Often the best results (for future use and minimal arthritic changes) are achieved with early intervention. Therefore, a more aggressive surgical approach is advocated. Although some animals do recover spontaneously, this can happen only if the flap breaks loose and is absorbed in the joint cavity. This process may take 9 to 12 months and bilaterally affected animals (incidence of 27 percent and 68 percent) are unlikely to recover to the point of clinical soundness.

When an animal is markedly lame in one leg, it is difficult to assess lameness in the contralateral leg. Both limbs should be radiographed even if only one limb is clinically lame. An additional danger is that the loose cartilage flap may survive within the joint to become a large ossicle (joint mouse) that will cause severe inflammatory changes and degenerative joint disease. If the flap never breaks free, a similar deterioration of the joint occurs. Partially attached flaps have been removed in 3-year-old dogs.

The best method for surgery would be through arthroscopy by a surgeon who has a significant amount of experience performing arthroscopies, since there is a learning curve associated with this method.

(continued on page 6)

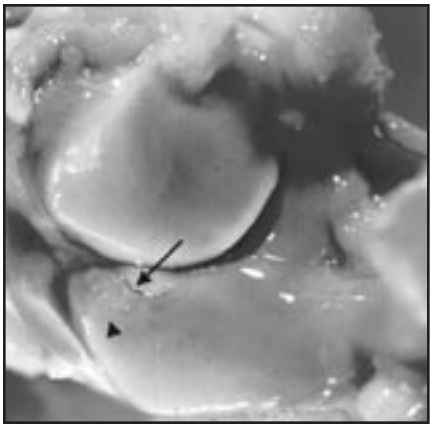
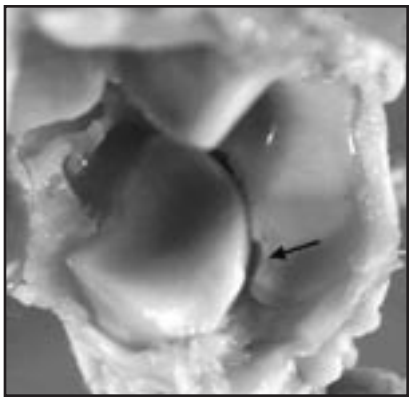


Figure 10. (Above) A gross tissue specimen of the articular surface of the radius (right) and ulna (left). The arrow points to a fissure in the cartilage. The arrowhead points to an area of roughened articular cartilage. These lesions would not be evident radiographically but could result in changes consistent with Grade 1 elbow dysplasia.

Genetic Databases

Figure 11. (Right) A gross tissue specimen of the articular surface of the radius (right) and ulna (left). The arrow points to the irregular articular margin between the radius and ulna. It appears that a portion of the ulna is missing (in the proximity of the coronoid process). This lesion would not be evident radiographically, but could result in changes consistent with Grade 1 elbow dysplasia.



Elbow dysplasia can be a crippling disorder . . . the best results are achieved with early intervention.

(continued from page 5)

Multiple studies support the theory that the various components of ED are heritable. The heritability index and incidence varies by the breed, component and population studied. It appears that the disorder is inherited polygenically with development being multifactorial. Both environmental factors and the additive effect of many genes contribute to expression.

The International Elbow Working Group (IEWG), a consortium of experts from around the world, was founded in 1989 to lower the incidence and prevalence of elbow dysplasia by coordinating worldwide efforts. These efforts include research, dissemination of information, formulation of guidelines for national registries and provision of education about elbow arthrosis.

It was necessary to develop a protocol for screening elbows that would be acceptable to the scientific community and breeders. It was agreed that ED was the manifestation of inherited FCP, UAP, OCD, articular cartilage anomaly and/or joint incongruity that resulted in elbow arthrosis. Until a DNA test is available for the detection of animals genetically predisposed for ED, genotype can only be estimated by knowledge of the evaluations of the extended family. The IEWG has continued to meet periodically to provide international discussions for the purpose of exchanging information and reviewing the elbow evaluation protocol.

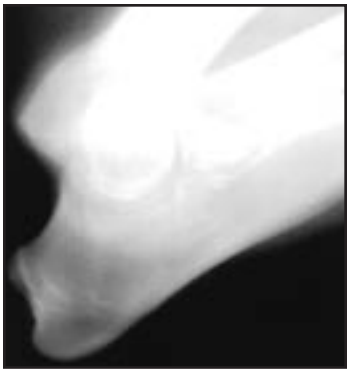
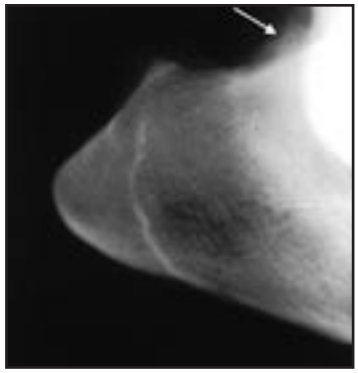
The OFA started its elbow database in 1990 using a modified protocol of the IEWG. Initially the database was semi-closed, but since July 1, 2000, owners have had the choice of an open database as well. When establishing criteria for a protocol for screening breeding animals, several aspects need to be considered. To encourage submission of data from multiple-dog owners (i.e., breeders) the cost must be reasonable. This should take into consideration the cost to the submitters of obtaining such data prior to the entry into the database.

The minimum age for certification must allow for detection of a significant number of affected dogs by that age and still allow for entry of an individual into the breeding program in a timely manner. Therefore, the OFA requires one view of each elbow in extreme flexion. Certification can be obtained at 24 months of age. The age of 2 years is well past the active stage of the disorders and arthritic changes should be evident on the lateral projection, regardless of the magnitude of the abnormality.

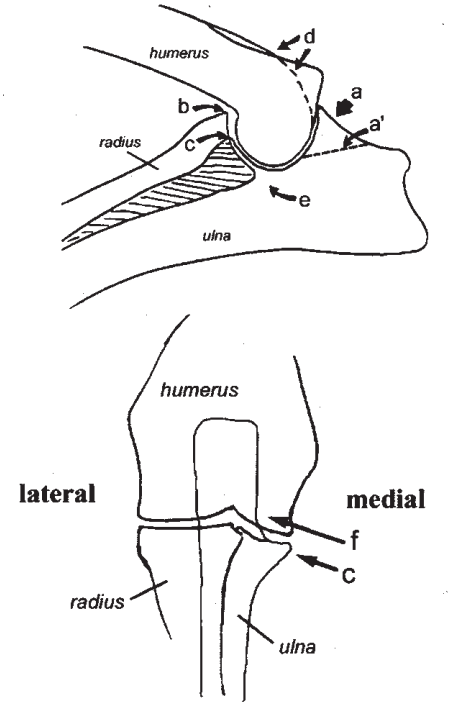
The OFA reports elbows as normal (Fig. 12) or dysplastic. The abnormals are graded as grades 1 (Figs. 13 & 14) through 3 (Fig. 15), with grade 1 being the least abnormal. The grades are differentiated by the relative amount of osteophyte formation on the anconeal process. The grades of dysplasia will facilitate the calculation of heritability.

Summary

Elbow dysplasia can be extremely debilitating. The onset is early and patients are bilaterally affected in a significant number of cases. Despite the ability to treat affected dogs, there is no satisfactory medical protocol or surgical procedure to significantly alter the progression or cure the disorder. This poor response to medical and surgical management is substantiated with force plate gait analysis pre- and post-therapy. This makes it increasingly important to reduce the incidence of the disease through selective breeding. Selectively breeding phenotypically normal individuals has been shown to reduce the incidence of the disorder.

(Left ro right) Figure 12. Extreme flexed lateral radiographic projection of a normal elbow joint. Figure 13. Extreme lateral radiographic projection of the elbow joint. The arrow shows the osteophyte development on the anconeal process. The elbow is an example of Grade 1 elbow dysplasia. Figure 14. Craniocaudal radiographic projection of the elbow joint. The arrow shows an osteophyte on the proximal ulna. This is an example of Grade 1 elbow dysplasia, but is not a required view for the OFA. Figure 15. Extreme flexed lateral radiographic projection of the elbow joint. The arrows show osteophyte development in the area of the anconeal process on the ulna, the caudal aspect of the humerus and the cranial margin of the radius. This is an example of a Grade 3 elbow dysplasia.



The Canine Elbow

a) Anconeal process, site of osteophyte development
a') Line of separation for UAP
b) Site of osteophyte development
c) Medial coronoid process
d) Site of osteophyte development
e) Trochlear notch
f) Site of osteochondrosis lesion

CHIC Update

Eighteen months after the announcement of the Canine Health Information Center, a joint endeavor of the Canine Health Foundation and the Orthopedic Foundation for Animals, seven breeds are participating in the project — Newfoundland, Bull terrier, Rhodesian Ridgeback, Mastiff, Basenji, Rottweiller and Labrador Retriever.

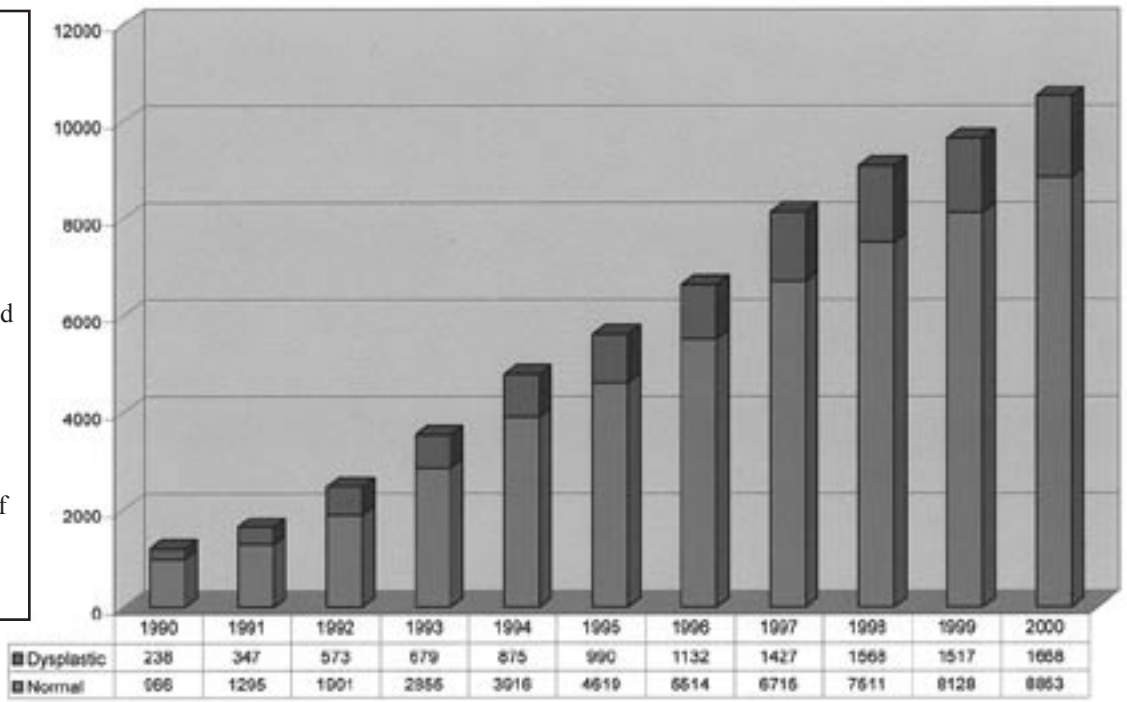
The CHIC was established to encourage the breeding of healthier dogs through the maintenance of breed specific databases. OFA veterinarians work with the health committees of breed clubs to identify genetic disorders that have a negative impact on affected individuals and for which a reliable method of evaluation is available.

Approximately 3,000 reports have been issued on dogs currently in the databases that met the criteria established by breed clubs. The Dalmatian and the Bearded Collie are in the process of finalizing their letters of intent and should be included in the project in the very near future.

Efforts to expand and to include more breeds are currently in progress. If your breed club would like to enter the project, a representative should contact the OFA office.

OFA's Elbow Dysplasia Database

From 1990 through 2000, 63,287 dogs were submitted to the OFA elbow database for evaluation. Nearly 21.1 percent of these dogs, a total of 11,014 dogs, were found to be dysplastic. In 2000, about 15.9 percent of the 10,521 dogs that were diagnosed were dysplastic.



Research Summaries

Recent publications of interest from OFA

Quantification of Measurement of Femoral Head Coverage and Norberg Angle Within and Among Four Breeds of Dogs

This study, utilizing radiographs and records provided by the Orthopedic Foundation for Animals, found that two commonly-used mathematical calculations of canine hip status may not accurately differentiate dysplastic hips from normal hips. The paper was published in the December 2000 issue of the American Journal of Veterinary Research.

OFA radiographs of 1,841 dogs were reviewed by James L. Tomlinson, D.V.M., M.V.Sci., of the University of Missouri College of Veterinary Medicine and data were statistically analyzed by Jane C. Johnson, M.A., of the Kirksville (Mo.) College of Osteopathic Medicine. They examined the use of "Norberg angle" and "percent coverage of the femoral head" in evaluating hip status.

Norberg angle is an objective method for detecting subluxation of the femoral head. It is a measurement of the positioning of the femoral head in relationship to the cranial acetabular rim, or hip socket. A hip with a Norberg angle of less than 105 degrees has been considered to be subluxated. Subluxation is an abnormality associated with hip dysplasia. In the veterinary literature, normal hip conformation includes coverage of at least 50 percent of the femoral head by the acetabulum. There are no studies investigating this amount of coverage for normal hips.

Digital scanners and computers were used to analyze the Norberg angles and femoral head coverages of radiographed hips. Labrador Retrievers, Rottweilers, Golden Retrievers and German Shepherd Dogs were selected for this study. These four breeds account for the largest numbers of OFA hip evaluations.

The Norberg angle and percent coverage of the femoral head were correlated to the OFA hip evaluations of the corresponding dog.

It was concluded that Norberg angle and femoral head coverage "had a strong correlation across OFA grades," but they found that the traditional means of defining the measurements did not correlate to the presence of hip dysplasia. "Percent coverage of 50 percent was not an accurate cut-off point for differentiating between normal and dysplastic hip status," they wrote.

"In addition, Norberg angle of 105 degrees is higher than any of the predicted values for Norberg angle found in our study and, therefore, does not appear to be an appropriate number to distinguish between normal and dysplastic hip status . . . Our predicted values for NA and PC support the premise that each breed potentially has different values for NA and PC."

Applying a Norberg angle measurement of 105 degrees or more and a femoral head coverage measurement of 50 percent or more "will err toward calling a dog dysplastic when its hip conformation is normal on the basis of actual OFA grading."

Tomlinson and Johnson suggested that a combination of Norberg angle and femoral head coverage measurements could correctly classify hip status 92 to 98 percent of the time if the cut-off point for each measurement was adjusted for the conformation of each breed.

For Norberg angle, they suggested a dividing measurement of 99.9 degrees for Labrador Retrievers, 101.9 degrees for Rottweilers, 92.6 degrees for Golden Retrievers and 100.3 degrees for German Shepherd Dogs.

The suggested femoral head coverage values are 42.2 percent for Labrador Retrievers, 42.7 percent for Rottweilers, 37.9 percent for Golden Retrievers and 44.8 percent for German Shepherd Dogs.

Effect of Dam and Sire Qualitative Hip Conformation Scores on Progeny Hip Conformation

This study determined the effects of using OFA canine hip conformation scores as breeding selection criterion on the hip conformation scores of the resulting progeny.

The paper was published Sept. 1, 2000, by the Journal of the American Veterinary Medical Association. The authors were Ann L. Reed, D.V.M., M.S., DACVR, G. Greg Keller, D.V.M., M.S. DACVR, and E.A. Corley, D.V.M., Ph.D., DACVR, all of the OFA staff, and Dale W. Vogt, Ph.D., and Mark R. Ellersiek, Ph.D., of the University of Missouri College of Agriculture, Food and Natural Resources.

Pedigree data were obtained from breed clubs and the American Kennel Club to identify 12,724 progeny for which OFA hip conformation scores, as well as the scores of dams and sires, could be identified. English Setters, Portuguese Water Dogs, Chinese Shar-Peis and Bernese Mountain Dogs were selected because these breeds have the highest OFA hip radiograph submission rates, allowing the largest numbers of parent and progeny hip scores to be compared.

Statistical analyses determined that there were not significant differences in hip conformation between sexes. The data also showed that the contributions of dams and sires to the hip conformation of offspring are significant, equal and additive.

"This is important because breeders are often tempted to place the blame on only one parent when litters with a high percentage of dysplastic progeny are produced."

Because the genes responsible for hip dysplasia appear to have an additive effect, "breeders can use phenotype (physical hip status) to selectively breed against hip dysplasia and, in turn, lower the prevalence of the disease.

(continued on next page)

Hip Dysplasia: A Feline Population Study

Hip dysplasia occurs in cats, but its frequency in the general cat population is not well documented. Since cats seldom have clinical signs referable to hip lameness, hip dysplasia has received little attention in this species. For this reason, breeding of some cats for specific traits may have resulted in inclusion of a predisposition to hip dysplasia without knowledge of the breeder. Hip dysplasia is defined as abnormal development of the coxofemoral joints.

While the Orthopedic Foundation for Animals hip registry mainly contains data on dogs, numerous requests for evaluation of hip conformation in cats also have been processed.

The Maine Coon Cat is over-represented in the group due to previous reports of hip dysplasia as a specific problem in that breed. From Jan. 1, 1974, through Dec. 31, 1995, OFA received 288 requests for evaluation of hip conformation in cats. Maine Coon cats accounted for 284 of the requests. Radiographic evidence of hip dysplasia, according to standard OFA grading protocols, was present in 21.1 percent of these cats.

This study was pursued to further determine the incidence of hip dysplasia in cats. The study population consisted of 684 cats from 12 breeds that were presented at the University of Missouri-Columbia Veterinary Medical Teaching Hospital from Jan. 1, 1991, through Dec. 31, 1995.

The study was prepared by Gregory G. Keller, D.V.M., M.S., Ann L. Reed, D.V.M., M.S., and E.A. Corley, D.V.M., Ph.D., of OFA; and J.C. Lattimer, D.V.M., M.S., of the University of Missouri Department of Veterinary Medicine and Surgery. The report was published in 1999 by the journal Veterinary Radiology & Ultrasound.

Most of the cats were presented for abdominal radiographs, but the images for these 684 cats did show the ventrodorsal projection utilized in OFA hip screenings. Each of these radiographs was evaluated independently by three diplomates of the American College of Veterinary Radiology to determine whether the hips were normal or dysplastic.

The frequency of hip dysplasia for the total population of cats was 6.6 percent. Hip dysplasia was found in 5.8 percent of Domestic cats, which accounted for 603 of the evaluations. The prevalence of dysplasia in the 11 purebred breeds was 12.3 percent, suggesting that the frequency may be breed-dependent. However, the purebreds were represented in small numbers in this study population, ranging from one to 28 animals for each breed.

The findings do raise the possibility that certain feline breeds have higher frequencies of hip dysplasia. The Persian and Himalayan, like the Maine Coon, are breeds with larger body types and that may be a contributing factor in the development of degenerative joint disease in predisposed animals. Breeds with a higher level of affliction also may be the result of a narrower base gene pool, increasing the effect of a single affected animal on the whole gene pool of the breed.

Female cats represented 45 percent of the study population but accounted for 60 percent of the dysplastic animals, a difference that was not statistically significant. This lack of a sex difference for hip dysplasia in cats corresponds to reports on dogs.

There were differences in the location of degenerative changes in feline hip dysplasia from those found in dogs.

Since hip dysplasia is present in cats, conscientious breeders should consider evaluating the cats in their breeding program. This advice particularly applies to the Maine Coon Cat, in which a high frequency has been documented. Larger population numbers need to be studied to establish the frequency of hip dysplasia in other purebred cats. A study documenting the mode of inheritance also would be beneficial.

Effects of Dams and Sires on Progeny Hips

(continued from previous page)

"The significant differences in percentages of dysplastic progeny among parents with excellent, good and fair hip joint conformation supports the OFA recommendations that only dogs with excellent or good hip joint conformation be used in a breeding program, and use of dogs with fair conformation is questionable."

If a dog with "fair" hip status has other highly desirable traits that might justify breeding, the percentage of offspring with normal hip joints can be increased by breeding to dogs with excellent or good hips. "However, it is important to incorporate information on hip joint conformation of relatives when making breeding decisions, regardless of the hip joint conformation of the individual dog."

The data covered the years 1972 to 1993. Dysplastic progeny decreased at rates of 0.64 to 1.12 percent annually in the four breeds. Meanwhile, dogs with phenotypically normal hips increased 0.95 to 2.5 percent per year. Excellent hip conformation increased 0.06 to 0.69 percent annually.

"Results indicated that hip conformation scores have moderate heritability in dogs and selection of breeding stock with better hip conformation scores will increase the percentage of progeny with phenotypically normal hip joint conformation. Differences in the percentages of dysplastic progeny among breeds reflect different degrees of selection pressure applied by breeders and, perhaps, differences in the heritability of hip dysplasia."

Reliability of early radiographic evaluations for canine hip dysplasia obtained from the standard ventrodorsal radiographic projection

Since 1972, the age of 24 months has been considered the minimum age for radiographic certification that dogs have a normal hip phenotype. However, there is an obvious economic advantage to eliminating dysplastic dogs from breeding programs as early as possible.

This study determined the reliability of preliminary hip evaluations performed by the Orthopedic Foundation for Animals. A retrospective analysis of data from the OFA was used to compare preliminary hip evaluations (at ages of three to 18 months) of 2,332 Golden Retrievers, Labrador Retrievers, German Shepherd Dogs and Rottweilers to final evaluations (after the age of 24 months).

The study was conducted by E. A. Corley, D.V.M., Ph.D., and Gregory G. Keller, D.V.M., M.S., of OFA; J.C. Lattimer, D.V.M., M.S., of the University of Missouri College of Veterinary Medicine; and M.R. Ellersieck, Ph.D., of the University of Missouri Agricultural Experiment Station. It was published in the Journal of the American Veterinary Medical Association in November 1997.

The statistics showed that the reliability of preliminary CHD evaluations increase along with the age of the dog and the degree of variation from borderline hip status of the preliminary evaluation.

The reliability of a preliminary evaluation of normal hip joint status was 100 percent for hips originally deemed excellent, 97.9 percent for hips rated good and 76.9 percent for hips rated fair. The reliability of preliminary evaluations of canine hip dysplasia ranged from 84.4 percent for hips originally rated mildly dysplastic to 97.4 percent for hips rated moderately dysplastic.

Golden retrievers, Labrador Retrievers, German Shepherd Dogs and Rottweilers were used for the study because the four breeds represent about half of OFA hip radiographs submissions, making a sufficient number of reports available for statistical analysis.

The OFA evaluations use the standard ventrodorsal radiographic projection that has been recommended for CHD evaluation since 1961 by the American Veterinary Medical Association. This view of the pelvis is taken with the hind limbs extended, parallel and rotated so that patellas are positioned over the midlines of the femurs.

Because the statistical reliability values for data from the four breeds were significantly similar, their data were pooled for analysis.

The reliability of preliminary evaluations, as compared to definitive evaluations performed at or after the age of 24 months, increased significantly as age at the time of preliminary evaluations increased. The reliability was 89.6 percent for preliminary evaluations performed at three to six months of age; 93.8 percent for dogs evaluated at seven to 12 months of age; and 95.2 percent for dogs evaluated at 13 to 18 months of age.

The reliability of preliminary CHD evaluations increase along with the age of the dog and the degree of variation from borderline hip status of the preliminary evaluation.

There was a corresponding decrease in false-negative and false-positive results as age at the time of preliminary evaluations increased. The false-negative rate was 8.9 percent for normal preliminary evaluations performed at three to six months; 6.0 percent for evaluations at seven to 12 months; and 3.8 percent for evaluations at 13 to 18 months.

The false-positive rate was 17.6 percent for dysplastic evaluations performed at three to six months; 10.0 percent for preliminary evaluations at seven to 12 months; and 8.5 percent for preliminary evaluations at 13 to 18 months.

Final hip evaluations performed at or after the age of 24 months represent the collective judgment of three veterinary radiologists. The statistics indicate a high degree of correlation in those judgments — when results of 1.5 million OFA hip evaluations by 35 radiologists were analyzed, it was found that all three radiologists agreed 94.9 percent of the time on a classification of normal, borderline or dysplastic phenotype.

The researchers cautioned that the results of the study may have been affected by two factors that could not be controlled — the screening of radiographs before they are submitted to OFA and the low follow-up rate on preliminary evaluations. The 2,332 dogs used in the study, for which preliminary and final evaluations were available, represented 28.2 percent of the 8,261 dogs from the four breeds for which preliminary evaluations had been submitted.

"The net effect of these two factors would likely to have been to bias results so that reported reliabilities may be higher than the actual reliabilities," they wrote.

The data support the continued use of two years as the minimum age for radiographic certification of a dog's hip joint status, they concluded, due to the lower reliability of preliminary evaluations of fair normal hips and mild dysplastic hips.

"The economic value of early screening of dogs for determination of hip joint status is obvious. The study reported here suggests that the test method used by the OFA, and generally accepted worldwide, is an appropriate method for early mass screening of hip joint status. High predictive values of positive and negative results reported for the four breeds suggest that the probability of retaining a dysplastic dog in the breeding gene pool, or of removing a normal dog from the gene pool, is low."

Elbow Video Coming Soon

A new OFA video on elbow dysplasia will soon be available. The video describes canine ED and OFA's evaluation and database procedures. An optional $10 donation covers the cost of production and handling. To request a copy of this video, please call OFA at (573) 442-0418 or write the foundation at 2300 E. Nifong Boulevard, Columbia, Mo. 65201-3856.

Owner choice of data disclosure

The Orthopedic Foundation for Animals has always had a semi-closed database that only discloses data for normal results. OFA has decided to allow owner choice regarding disclosure of data from individual animals.

At the time of submission, the owner must choose whether abnormal results are to be released. If no choice is made, only normal results will be disclosed for individuals. The new policy will not affect information currently in the database.

If an owner chooses to change the disclosure status of information in the database, a form can be completed, signed and submitted.

OFA's Permanent Identification Policy

The OFA has adopted a policy, effective January 1, 2001, that will acknowledge animals that have been submitted for inclusion in our databases that have permanent identification in the form of DNA profile, microchip or tattoo. Animals not permanently identified will continue to be evaluated; however, they will be issued a number clearly indicating that the animal has no permanent identification.

New OFA Fees Take Effect

Effective Jan. 1, 2001, OFA hip and elbow evaluation fees increased by $5.00. The new fees follow.

Hip and/or Elbow Certification (24 months of age or older)	
Hips Only	$30
Hips plus elbows submitted together	$
Elbows only	$25
A litter of 3 or more submitted together	$75

Kennel rate
Applies to individuals submitted as a group, owned/co-owned by the same person. A group of 5 to 10 individuals submitted together is $15.00 per study. More than 10 individuals submitted together is a total of $150.00. There is no additional charge for studies on 11 and more individuals submitted at the same time.

Preliminary Hip and/or Elbow Evaluation (Under 24 months of age)	
Hips or elbows only	$25
Hips plus elbows submitted together	$
A litter of 3 or more submitted togethe	$45

Consultation
Any other radiographic study (thorax, abdomen, etc.) $25 per animal

Soft Tissue Databases
DNA, thyroid, patella and cardiac database fee will not change ($15.00 per submission).

Visit Us on the Web!

The web site of the Orthopedic Foundation for Animals, http://www.offa.org, is user-friendly and includes detailed information about each of the foundation's disease databases.

The ADVOCATE

In this issue:

Examining Elbow Dysplasia

The ADVOCATE

The Orthopedic Foundation for Animals Inc.
2300 Nifong Boulevard
Columbia, Missouri 65201 USA

A not-for-profit organization