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Griselda Hanlon

University of Minnesota, St. Paul

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The Abnormal Coxofemoral Articulation in the German Shepherd Dog

GRISELDA HANLON¹
University of Minnesota, St. Paul

ABSTRACT—A common abnormality among dogs of the coxofemoral articulation, known as developmental hip dysplasia, is discussed with special reference to its occurrence in the German Shepherd breed. Some observations made from serial radiographic studies of the maturation of normal and abnormal coxofemoral articulation of 200 experimental German Shepherd dogs are presented, and a method of measuring the ilio-acetabular angle is described. Further evaluation will be made of the angle as an early predictor in the course of developmental hip dysplasia.

A common aberration of the coxofemoral articulation of the dog is a hereditary disease known as developmental hip dysplasia. The abnormality is characterized by a gradual disassociation of the femoral head from its acetabular cavity that, in time, encourages various degrees of degenerative and proliferative changes of the joint tissues and culminates in osteoarthritis.

Hip dysplasia is widespread in the larger breeds of dogs and is especially prevalent in the German Shepherd. Symptoms of dysplasia rarely occur before 4 months of age; they are more likely to become apparent when the animal is between 6 and 18 months old. Mild degrees of the disease may go unrecognized until the animal reaches middle or old age. Symptoms range from a slightly disturbed or awkward gait to a severe crippling condition in which there is extreme posterior incoordination and muscle atrophy. In this state, the animal is reluctant to rise or move about without encouragement or assistance.

The condition is incurable and treatment is limited to alleviating pain and retarding the progress of the joint pathology. Hip dysplasia is by far the most common single entity affecting the coxofemoral articulation of the German Shepherd. The same prevalence may exist in other breeds, but the working ability of the Shepherd as a sentry for the armed forces, in police work, or as a guide dog for the blind, has placed this breed under close observation and scrutiny. Breeders and fanciers of the German Shepherd Dog are also well aware of the graceful stride that is characteristic of the breed. The gait, therefore, has always been an important feature in selected breeding programs.

Investigations both in America and Sweden have shown the disease to be hereditary (Henricson and Olsson, 1959; Snavelly, 1959), but the mode of inheritance is not fully known. It does not appear to be a simple monogenic recessive or dominant. Matings of normal individuals produce a significant number of dysplastic off-

spring but far less than do the purposeful matings of dysplastic individuals. These findings have discouraged the use of the dysplastic animal for breeding purposes.

The diagnosis of hip dysplasia is confirmed by radiologic examination. Radiographic signs of advanced dysplasia are not difficult to detect and are characterized by deformities and osseous proliferations of the acetabulum, femoral head, and neck. The deformed head can be partially or completely dislocated. Radiographic interpretation early in the course of the disease, however, has been discouraging. Many animals remain in an undetermined category for months before characteristic signs become apparent, and some animals never quite meet the criteria of either a normal or an abnormal pelvis. This particular classification is costly for those persons engaged in breeding and training programs who have reason to maintain these animals until conclusive evidence for or against the disease is present.

The College of Veterinary Medicine, University of Minnesota, is currently investigating various aspects of this disease. One phase has been designed to study the course of dysplasia and the maturation of the normal pelvis by serial radiographic evaluation. A standard method for positioning, with the animal under complete anesthesia, was devised to best display the coxofemoral articulation on the radiograph. Serial radiographs are then taken biweekly, weekly, or monthly until the animals are 12 months old and are followed by semi-annual radiographs to 36 months of age. Of 200 dogs studied to date, the following observations have been made:

- 1) The acetabulum and femoral head epiphysis are not ossified at birth in the normal and dysplastic individuals.
- 2) Ossification of the femoral head occurs between day 12 and day 21 in both the normal and dysplastic individual.
- 3) The femoral head is within the confines of the acetabulum at the time of ossification and through day 60 of both normal and dysplastic individuals.
- 4) A separate ossification center on the dorsolateral border of the acetabulum appears on the radiograph from day 118 to day 153 and fuses with the acetabular bones within 5 to 10 days. This center is not always seen on the radiograph and appears

¹ B.S., 1943, Montana State College; D.V.M., 1952, University of Minnesota; M.S., 1955, University of Minnesota. Hooper Foundation, Entomology, 1944, University of California, Berkeley; U.S.N. Epidemiology, 1945, University of Minnesota; Instructor, Department of Veterinary Surgery and Radiology, 1955; Assistant Professor, Department of Veterinary Surgery and Radiology, 1964. Publications include field of skeletal maturation and abnormal bone growth in the dog; and contributions to *Atlas of Veterinary Radiology*.

to be a more consistent finding in the normal than the abnormal pelvis.

- 5) Fusion of the ilium, pubis, and ischium to form the acetabular cavity is complete by 6 months of age in both normal and abnormal pelvises.
- 6) Ossification of the dorsal brim of the femoral neck is complete by 9 to 12 months of age. Abnormal proliferation of this area is often an early diagnostic finding in the course of the disease.
- 7) The disassociation of the femoral head from the acetabulum is one of the earliest consistent findings in dysplasia. This positional aberration is followed shortly by stress patterns on the acetabular margins.
- 8) As the disease progresses, the femoral head may move laterally and beyond the confines of the acetabulum (luxoid classification) or may become totally dislocated. This degree of dysplasia is usually reached rapidly and by the time the animal is 5 to 8 months of age.
- 9) One individual maintained a normal classification until 36 months of age after which unilateral dysplasia developed.
- 10) Unilateral dysplasia usually progresses to a bilateral involvement from 2 to 12 months later.

Recently, an interesting observation was made of the dorsal ilio-acetabular shadow on the radiographs of 3- and 4-month-old individuals. The shadow appeared deficient in animals that later developed dysplasia when compared to the shadows of animals that remained in a

normal classification at 3 years of age. A method of measuring the lateral angle of this shadow was devised and is illustrated in Fig. 1. A base line, *a*, is drawn across the radiograph and at the bottom of the ilio-acetabular shadow bilaterally. Another line, *c*, is drawn along the lateral margin of the ilio-acetabular shadow to the base line, *a*. The inside angle is then measured. The results of the few radiographic measurements made of angle *C* on the 3-month radiographs were encouraging (see Fig 2). The normal individuals appear to range below 132° and the dysplastic above this figure. The 4-month evaluation also showed a significant grouping of the normal individuals below, and the dysplastic individuals above, 120° . A triangle was then formed by drawing line, *b*, that extends from the base line, continues adjacent to the acetabular rim, and through the shadow of the anterior tip of the acetabular inlet. Angle *B* was then measured. Angle *B* did not appear to be as good an indicator as angle *C* in this limited study. The measurement of these angles will be pursued and further evaluated as studies continue. A predictor is badly needed for the early diagnosis of the abnormal coxofemoral articulation in hip dysplastic individuals.

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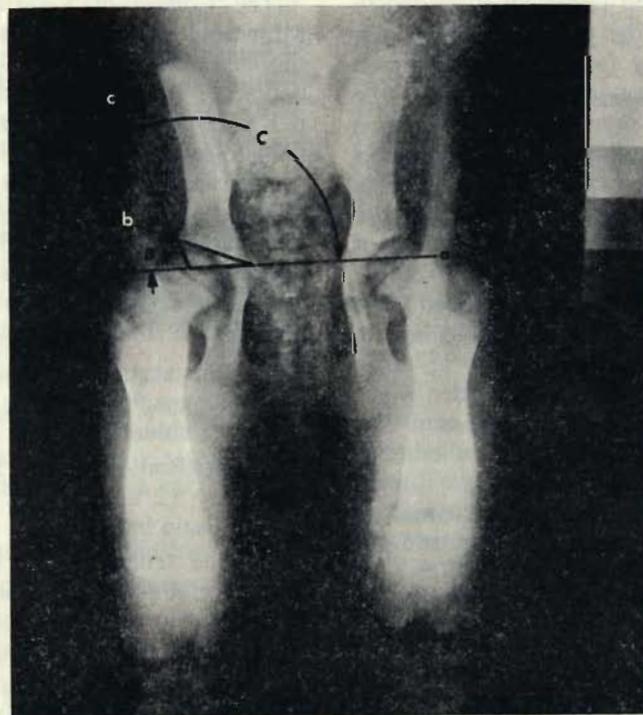


FIGURE 1.

ILIO ACETABULAR ANGLE

German Shepherd Dogs

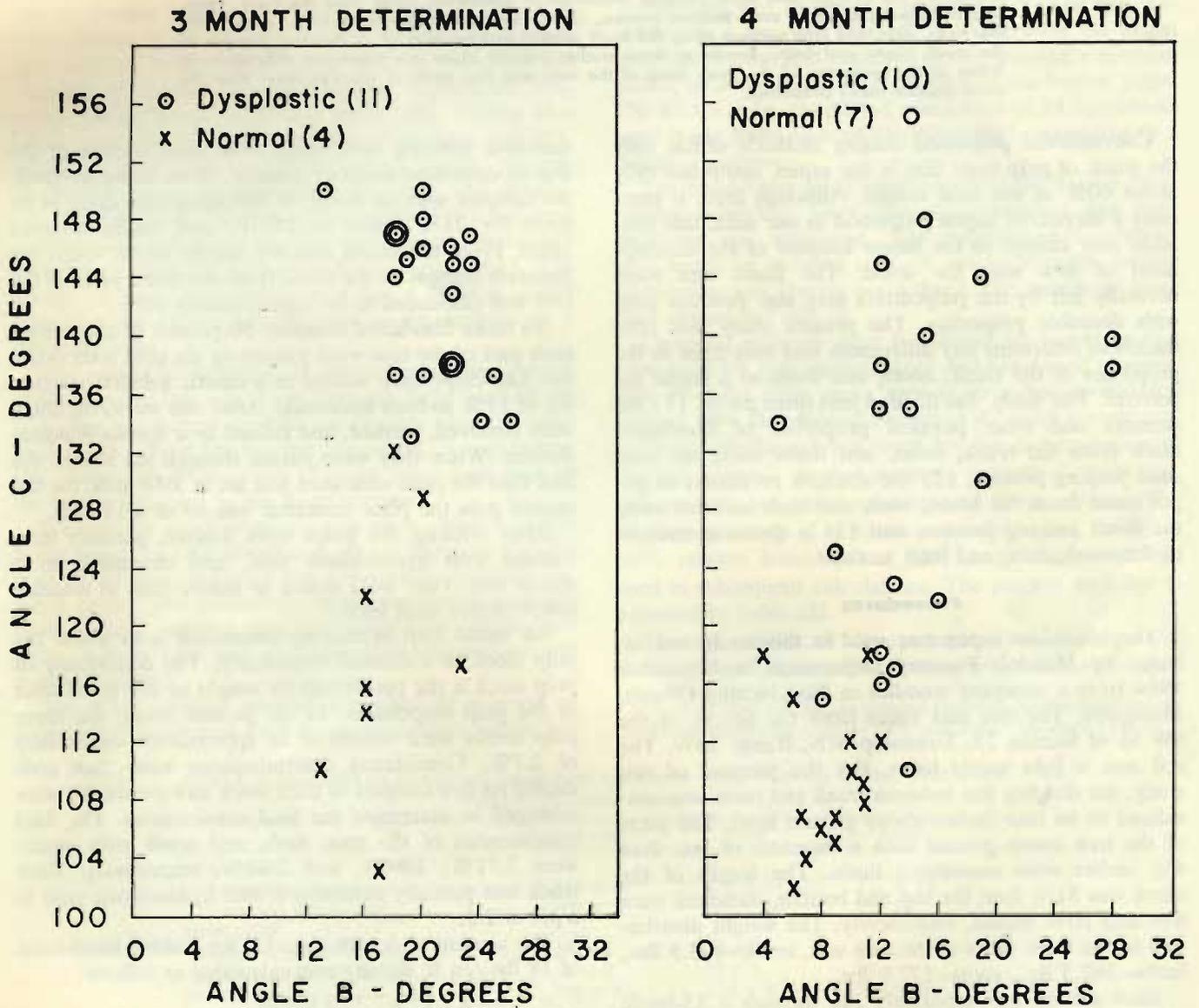


FIGURE 2.