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EARLY DIAGNOSIS OF CANINE HIP DYSPLASIA
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Canine hip dysplasia (CHD) is a complex, multifactorial, progressive disease that develops during postnatal skeletal growth. CHD in the growing dog is clinically characterized by increased dorsal acetabular rim (DAR) slope and functional hip joint hyperlaxity that permit pathologic dynamic coxofemoral subluxation and the development of secondary joint remodeling and degeneration. Veterinarians are frequently challenged to diagnose CHD in growing dogs prior to the onset of these irreversible secondary changes so that proper treatment can arrest the progression of the disease and alter its pathogenesis.

Passive hip joint laxity refers to laxity that can be demonstrated in puppies by means of external veterinary manipulations (Ortolani test, Barden test, PennHIP distraction index). Some degree of passive hip joint laxity is detectable via PennHIP in all dogs. Passive hip joint hyperlaxity measured by PennHIP radiography is a heritable phenotype of CHD as well as a breed-specific risk factor for the development of osteoarthritis (OA). Detectable passive hip joint laxity does not always relate directly to the development of CHD symptoms or OA. From a therapeutic standpoint, the challenge faced by veterinarians is to detect or infer functional hip joint hyperlaxity in which dynamic subluxation occurs spontaneously during daily patient activities.

Signalement
Many large breeds of dogs develop CHD, but the most commonly presented breeds include Golden Retrievers, German Shepherds, Rottweilers, Labrador Retrievers, Chesapeake Bay Retrievers, Saint Bernards, and English Mastiffs. Puppies are seldom presented because of symptomatic concerns prior to 4 to 5 months of age.

History
Pet owners often present their puppies for veterinary evaluation of vaguely expressed concerns such as pelvic limb weakness, reluctance to rise, climb stairs or jump, and intolerance of extended periods of exercise rather than for discrete lameness. Increasingly, asymptomatic puppies are presented for screening evaluation in consideration of prophylaxis via juvenile pubic symphysiodesis (JPS).

Gait Evaluation
Many growing dogs with functional hip joint hyperlaxity display a “tight skirt” gait at a walk or trot in which they do not fully extending their hips. A “bunny-hopping” gait at a walk or trot or when ascending stairs may be noted. Dynamic hip subluxation/reduction can be visualized and/or heard in some puppies while they walk.

Hip Palpation
While an assistant leads the puppy at a walking gait, the examiner places his/her hands on the pup’s hips. When
detected, palpable dynamic hip subluxation/reduction is a definitive indicator of functional hip joint hyperlaxity.

The examiner can also place his/her hands on the puppy’s hips and gently sway the hind end from side to side in order to detect palpable subluxation/reduction. Hip extension and abduction are often painful. The Ortolani test can be performed in the unsedated, standing or laterally recumbent puppy if it is cooperative, but a negative finding is not definitive.

Next, the puppy is heavily sedated or anesthetized for definitive hip palpation and radiography. The Ortolani test is performed in lateral or dorsal recumbency or both. The Ortolani test, a palpation test for passive hip joint laxity, requires some inference to conclude that functional hip joint hyperlaxity is present. When initiating the Ortolani test, the hip is held in a neutral standing angle so that the joint capsule and periarticular tissues are in their passively relaxed state (inadvertently holding the hip in extension, flexion, internal or external rotation may tighten the joint capsule and periarticular tissues causing hip joint laxity to go undetected). Next, an axial compressive force is applied down the length of the femur (from stifle toward hip) as the hip is abducted from the neutral position. Palpable reduction of the femoral head into the acetabulum during abduction is referred to as a “positive Ortolani sign”. When a positive Ortolani sign is detected, the examiner should measure and record the angles of reduction and subluxation. Measurement of these angles with an electronic goniometer (Slocum Enterprises, Eugene, Oregon, USA) is most repeatable in our hands. The angle of reduction is indicative of hip joint laxity. The angle of subluxation is indicative of DAR slope. Careful palpation of reduction and subluxation is also important. Indistinct reduction suggests acetabular filling or remodeling. Indistinct subluxation or a biphasic subluxation suggests DAR erosion.

Radiographic Examination
A ventro-dorsal, hips-extended radiograph is evaluated for degenerative changes such as osteophytosis, shallow acetabula, femoral head flattening and thickening of the femoral necks. Coxofemoral subluxation may also be detected on this view, but it is important to remember that marked hip extension tends to artificially “tighten” the hip joints. Therefore, subluxation present on this view is real, but the absence of subluxation does not rule-out hip joint hyperlaxity. A hips-abducted (“frog leg”) radiograph is helpful to assess acetabular depth because acetabular remodeling is easier to detect when the femoral heads are compressed into the acetabula. A DAR-view radiograph of normal hips shows a “beak-shaped” DAR contour and minimal slope. In dysplastic puppies with advancing hip degeneration, there is blunting of the lateral DAR margin and increased DAR slope. PennHIP radiography includes a passive distraction view from which a distraction index (DI) is calculated. For this view an adjustable, padded, radiolucent apparatus is placed between the thighs of the dorsally recumbent dog. The hips are placed in an approximate standing angle and gently adducted until the medial thigh surfaces are firmly in contact with the apparatus such that passive hip joint distraction occurs. The radiographs are sent to PennHIP for measurement of DI and inclusion in their database. Other distraction radiography views have been described and each have their own advantages and disadvantages.

Other Examination Tools
Computed tomography (CT) can be used for accurate evaluation of DAR integrity and acetabular depth, though consistency in patient positioning and scan landmarks is critical. Arthroscopic evaluation of the coxofemoral joint is the most sensitive indicator of synovitis, round ligament tearing and chondromalacia.