Renal dysplasia in Soft-Coated Wheaten Terriers:

10 Years of Experience with Dogs along the Front Range of Colorado

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Renal dysplasia (RD) is defined as the abnormal differentiation of kidney tissue such that inappropriate or anomalous structures appear within the renal parenchyma. There is disorganization of renal architecture with abnormal tubulogenesis, abnormal glomerulogenesis, cyst formation, and immature nephronic (immature nephrons) and ductal structures (immature renal ducts). In the normal embryonic and fetal development, tubular development occurs from metanephric tissue and proceeds in concert with branching of the ureteral buds. Glomeruli form from blood capillaries that invaginate into, or are surrounded by, the terminal end of the tubular structures.

RD is presumed to be familial in the Lhaso Apso, Shih Tzu, Soft Coated Wheaten Terrier, and is suspected to be familial in the Alaskan Malamute, American Cocker Spaniel, Bedlington Terrier, Chow Chow, Golden Retriever, Keeshond, Miniature Schnauzer, Standard Poodle, and Weimaraner.

RD was first described in related Soft Coated Wheaten Terrier (SCWT) dogs in the 1980s in Europe. It has been reported in both sexes, with affected dogs ranging in age from 1-30 months. In 1984, two articles were published in the Journal of Small Animal Practice regarding RD in Wheaten Terriers. Nash, Kelly, and Gaskell from the University of Liverpool described 7 SCWTs with chronic renal disease. The oldest dog was 2.5 years of age, and the other six died between 1 and 15 months of age. Three of the dogs were in two litters of the same sire and dam. This pairing produced four litters during a 4-year period, with a total of 18 puppies weaned. Nine died before 3 years of age, though only 3 of 9 were studied.

Eriksen and Grondalen from the Norwegian College of Veterinary Medicine describe chronic renal failure in 5 to 10 dogs in two litters having the same parents. The dogs died or were euthanized between 7 and 30 months of age. Both the dam and sire were imported from Sweden.

Currently, RD is believed to be genetic, autosomal, and recessive. Dysplasia may be related to a primary error in renal maturation. It could also be a nonspecific response of the developing kidney to injury. The insult could be a circulating nephrotoxin, ischemia, or urinary obstruction, as documented in humans. In one report, puppies infected with canine herpesvirus had tubular and glomerular lesions consistent with dysplasia.

VetGen has reportedly discovered a linked DNA marker to a required genetic determinant of RD in three breeds, including SCWTs. They report that there is strong linkage between this marker and the defective gene such that about 95% of the definitely affected dogs in these breeds have one or two copies of an allele we have called M (standing for marker). At this marker locus, there is only one other allele called N (for normal). The population frequency of the M allele in the Shih Tzu, Lhasa Apso, and Wheaten Terrier is about thirty percent. [For more info about VetGen's RD marker work, see www.vetgen.com/renaldys.html

Clinical signs of RD can include increased water drinking and urination, dilute urine, decreased appetite, lack of vigor, weight loss or failure to gain weight, and vomiting. Kidney failure often manifests at less than one year of age.

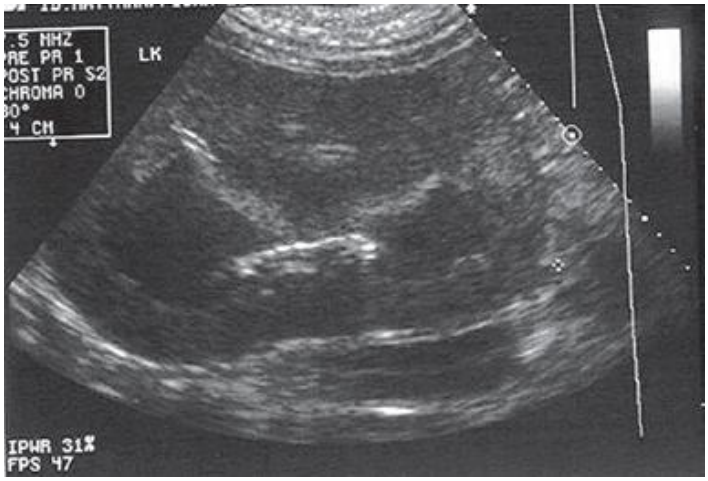
Screening tests for RD include a biochemical profile, complete blood count CBC), urinalysis, abdominal radiography and/or ultrasound, and wedge biopsy of the kidney.

Serum creatinine and BUN will stay normal until less than 25% of renal function exists, so abnormal values are not a sensitive indicator of renal function.

Urine concentrating ability, which is not fully mature until puppies are 12 weeks of age, is often affected in puppies with RD. A dog with RD is unable to concentrate, or conserve urine, and may drink increased water in order to compensate for the loss. Urine with a specific

gravity of greater than 1.035 is considered concentrated. Dogs with renal compromise often have a urine specific gravity between 1.010 – 1.015

Keep in mind that renal reserve has to drop below 33% before concentrating ability is lost, so a dog with mild RD may have normal concentrating ability. Proteinuria is not a prominent characteristic of RD.



Normal left kidney

On ultrasound, dysplastic kidneys are usually small but may appear larger if cysts are present. Echogenicity is usually increased, and the distinction between the cortex and medulla is decreased.

Normal renal size for a 5-9 kg. dog is 3.2-5.2 cm; 5.0-6.7 cm for a 15-19 kg. dog and 5.2-8.0 cm for a 20-24 kg. dog.

The medulla has a hypoechoic round appearance, and the cortex surrounds the medulla. Between the medulla, slightly hyperechoic bands are seen. At the center, the renal pelvis is hyperechoic due to fat. The renal borders should be smooth.

Renal wedge biopsy is a sensitive way of determining whether RD is present.

With RD, a biopsy will show decreased numbers of glomeruli, immature (fetal) glomeruli, and cystic glomerular atrophy. There may be segmental interstitial and periglomerular fibrosis. In the renal medulla, changes include atrophy, dilatation, basement membrane mineralization, interstitial fibrosis, and adenomatous proliferation of the collecting duct epithelium. Unfortunately biopsy is not without risk or expense. Needle biopsy can also be considered, but obtaining adequate numbers of glomeruli for examination is not as certain as with wedge biopsy.

Ultrasound results of Wheatens in the greater Denver area (1995-2005)

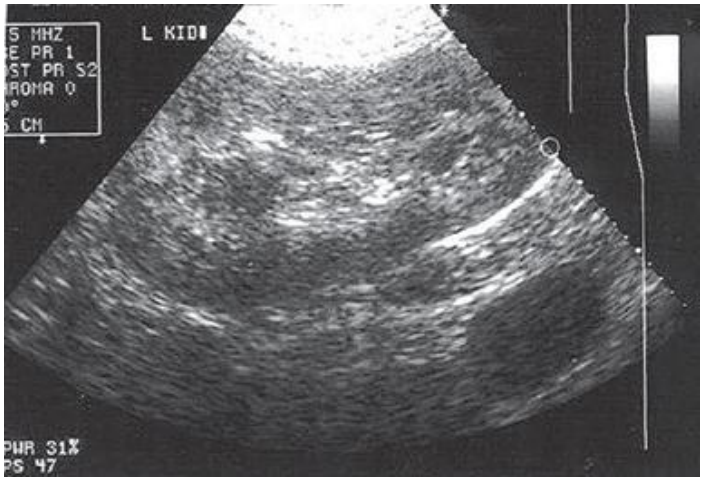
Our method of ultrasound is as follows: puppies are examined without sedation and in a standing position. The hair coat is not clipped as is standard with ultrasound, but wetted with alcohol. Ultrasound gel is liberally applied. Both the left and right kidney are imaged caudal to the last rib. Sagittal views of both kidneys are obtained using a 7.5 mg Hz transducer. The length of the kidney is measured and pictures are taken of both kidneys in a sagittal view. Abnormalities seen with RD include decreased renal size and abnormal architecture. The cortex is often thick and there is poor distinction between the cortex and medulla.

Over a ten-year period, 528 SCWTs along the front range of Colorado had renal ultrasound performed. Most were puppies between 7-9 weeks of age. The oldest dog that was included was 4 years of age. RD was suspected in 16 puppies (3%). Most, but not all of these 16 puppies subsequently had renal histopathology done which confirmed RD. So far, none of the dogs classified as normal were later shown to have RD. Kidneys did not have normal architecture in an additional 13 dogs (2.5%).

A total of 5.5% of all dogs that had ultrasound performed were classified as abnormal. Most of the dogs with abnormal architecture not consistent with the typical appearance of RD are alive at 2+ years of age and are clinically normal. Typically, a rim sign was seen, which is a hyperechoic, or bright line, at the corticomedullary junction. A rim sign is a nonspecific finding which indicates any insult to the kidney.

There is no information in the literature to determine whether dogs with this change will have a normal life expectancy or not.

Dysplastic left kidney



Questions that remain to be answered relative to RD in the SCWT include:

1. How sensitive/specific is renal ultrasound?

2. Are the questionable kidneys normal or abnormal? Could they be a variant of RD?

3. What is the true prevalence of RD in SCWTs?

4. Is RD a significant concern in the breed?

5. Should ultrasound continue to be used to screen puppies for RD?

Further research into this area should include wedge biopsy of any abnormal appearing kidneys. The tissues should ideally be sent to the same laboratory/ pathologist who is experienced in diagnosing RD.

HELPFUL DEFINITIONS:

Autosomal = describing any non-sex determining chromosome.

Recessive = a trait is recessive when two copies of a disease-causing gene (one from each parent) are required to cause a specific problem.

Congenital = present at or existing from the time of birth.

Familial = occurring in or affecting more members of a family that would be expected by chance. Some familial diseases are genetic and others are acquired.

Hereditary = genetically transmitted from parent to offspring.

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