



# THE COTON DE TULEAR CLUB OF THE UNITED KINGDOM

Society Registration No: 2049

## **CHONDRODYSPLASIA AND CHONDRODYSTROPHY (IVDD)**

We have all seen CDDY (Chondrodystrophy) and CDPA (Chondrodysplasia) on DNA test forms, and many of you have been testing for the conditions, but have you stopped to think what the origin of these words are and where they fit in with Intervertebral Disc Disease.

The definition of Chondrodystrophy and Chondrodysplasia is as follows:

**Chondrodystrophy** (literally, "cartilage maldevelopment") refers to a skeletal disorder caused by one of myriad of genetic mutation that can affect the development of cartilage.

**Chondrodysplasia** refers to a hereditary skeletal disorder characterized by the arrested development in dogs resulting in short leggedness.

Source: Wikipedia (11.4.2019)

### **What is canine Chondrodysplasia and Chondrodystrophy**

#### ***Chondrodysplasia (also known as canine dwarfism)***

This a genetic skeletal disorder associated with abnormalities in the development of cartilage tissues. Affected dogs suffer from disproportionate short-limbed (dwarfism) and/or hyperplasia of the skull bones. Visible symptoms occur only during the growth period when bone formation occur via the growth plates of the long bones. Other skeletal characteristics are a more protruding lower jaw than normal, an unusually shorter upper jaw and an over or under shot bite with crooked teeth.

Source Animal Meds

#### ***Chondrodystrophy (CDDY)***

This is a trait that defines many dog breeds and as with Chondrodysplasia is characterised by the reduction to the long bone length because of early changes in the structure of growth plates. CDDY can also impact the health of animals through an abnormal process that causes premature degeneration of the intervertebral disc. This condition also causes the premature calcification of the inner layer of the disc at an early age and results in degeneration of all discs in young dogs. It is these abnormal discs that are predisposed to herniation into the spinal canal. When the disc ruptures and herniates, it causes damage to the spinal column, severe pain and neurological dysfunction termed as Intervertebral Disc Disease or IVDD and carries a high mortality rate, together with high cost of surgical and medical veterinary care.

Source UC Davis 9/10/2017

### **What gene causes Chondrodysplasia and Chondrodystrophy**

Through extensive research, genetic research companies have been able to identify two retrogene insertions FGF4 (Functional Fibroblast Growth Factor 4) which explains short-leggedness in dogs. The FGF4 gene is involved in many processes including bone development.

The first insertion discovered (Parker et al 2009) is an FGF4-retrogene insertion in the dog's chromosome 18 and explains short-leggedness and is seen in such breeds as Basset Hound, Pembroke



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Welsh Corgi, Dachshunds, West Highland White Terrier and Scottish Terrier and is considered to follow an autosomal dominant mode.

The Chondrodystrophy (CDDY) mutation was recently discovered by researchers in Bannash Laboratory at the University of California, Davis (Brown et al. 2017) as a second FGF4-retrogene insertion in the dog's chromosome 12. CDDY includes short-leggedness and abnormal premature degeneration of the intervertebral disc leading to a susceptibility to Hansen's type 1 Intervertebral Disc Disease (IVDD).

Source UC Davies (9/10/2017)

## **Is CDPA and CDDY Heredity?**

The simple answer to this question is Yes. Both CDPA and CDDY can be inherited as a semi-dominant trait for height which means dogs with 2 copies of the mutation are smaller than dogs with only 1 copy.

Research companies have also found, with respect to IVDD, the inheritance follows a dominant mode. This means that a dog need only have one copy of the FGF4-12 mutation to be predispose to IVDD. However, dogs who have both FGF4-12 and FGF4-18 will show a more drastic reduction of leg length and are more at risk of IVDD.

## **Are there any DNA Test for this condition?**

UC Davis have been offering tests for this condition for some time and from June 2018, Genomia, Animal Genetic, Laboklin now offer combined DNA tests for our breeders. These tests will detect whether a dog has the mutation in either of the FGF4-chromosome 12, 18 or both.

The reported results are as follows:

### **Chondrodysplasia**

N/N	No copies of CDPA mutation.
N/CDPA	1 copy of CDPA. Mutation causes leg shortening compared to N/N dogs.
CDPA/CDPA	2 copies of CDPA. Mutation causes leg shortening compared to N/N dogs.

### **Chondrodystrophy (CDDY and IVDD Risk)**

N/N	No copies of CDDY mutation.
N/CDDY	1 copy of CDDY mutation. Dog is at risk for IVDD. Mutation causes leg shortening compared to N/N dogs. When bred to an N/N dog will produce 50% of normal sized puppies and 50% of puppies at risk for IVDD.
CDDY/CDDY	2 copies of CDDY. Dog is at risk for IVDD. Mutation causes leg shortening compared to N/N dogs. Will produce 100% of puppies with shorter legs at risk for IVDD.

Source: UC Davis



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## **Should I be worried with a CDPA/CDPA result?**

Following recent DNA test results, received from Laboklin, Animal Genetics and Genomia it is clear our breed will (in most cases) carry two copies of the CDPA gene and therefore it is our understanding that this should not pose any health issues within our breed at this time.

## **Which breeds can carry CDDY?**

CDDY variant has been found in breeds such as: Basset Hound, Beagle, Bichon Frise, Cardigan Welsh Corgi, Cavalier King Charles Spaniel, Chesapeake Bay Retriever, Chihuahua, Chinese Crested, American Cocker Spaniel, Coton de Tulear, Dachshund, Dandie Dinmont Terrier, English Springer Spaniel, French Bulldog, Havanese, Jack Russell Terrier, Nova Scotia Duck Tolling Retriever, Pekingese, Pembroke Welsh Corgi, Poodle (Miniature and Toy), Portuguese Water Dog, Scottish Terrier, Shih Tzu. **This is not a complete list of breeds. Research on the distribution of this mutation across breeds is ongoing.**

## **What should I do if my dogs test positive for CDDY?**

As with all test results it is only an indication that your dog carries the mutated gene and **does not** indicate your dog will contract IVDD in the future. Dogs whose test results show them to be N/CDDY should only be bred with N/N and with careful breeding it should be possible to breed this mutation out of your breeding within a few generations.

Dogs whose test results show them to be CDDY/CDDY means that your dog is more likely to be predisposed to IVDD in the future. However, as with N/CDDY it is only an indication your dog could be more at risk of contracting IVDD but not necessarily. Unfortunately, if you breed a dog with 2 copies of CDDY then 100% of puppies from this breeding could have shorter legs and be more predisposed to IVDD.

## **What should I do if my dog has 2 copies of both CDPA and CDDY?**

Research is still ongoing to determine if dogs whose test results show they have two copies of both CDDY and CDPA are more prone to IVDD than dogs which test positive for CDDY only.

It should be noted that CDDY and CDPA occur in many breeds and where both mutations are present, then research companies recommend that you consider implementing a breeding strategy to reduce incidence of CDDY, while retain the short-leggedness conferred by CDPA.

*Source: UC Davis  
Animal Genetics*

We have touch on Intervertebral Disc Disease and the possible association with CDDY in the above information and therefore feel that we should now spend a little time explaining what IVDD is, its causes and treatment.



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## **INTERVERTEBRAL DISC DISEASE (IVDD)**

### **Where does the Intervertebral disc sit?**

The intervertebral disc sits between the vertebrae and is composed of an outer fibrous layer made up of 70% collagen and an inner gel-like layer. These structures allow the spinal column to flex, act as a shock absorber and aids movement.

### **Cause of Intervertebral Disc Disease (IVDD)**

IVDD is caused by the hardening of the disc or discs which acts as shock absorbers between the spinal column and eventually hardens to such an extent that they can no longer provide the cushioning effect they are designed for. This disease can affect dogs throughout their lifetime but tends to show up anytime from 3 year of age onwards and can occur slowly overtime, intermittently or very suddenly.

There are two different ways in which IVDD presents itself in dogs, either after a forceful jump or awkward fall., which can cause an already weakened disc to burst and press onto the spinal cord or alternatively, the already hardened or weakened discs can eventually cause them to bulge and compress the spinal cord. In either scenarios damage of the nerve impulses that control the bladder and bowel can be impaired, in addition to potentially causing paralysis.

### **What are the symptoms of IVDD?**

#### ***Mild Symptoms***

Lowered head,  
Reluctance to move  
Stiffness  
Sensitivity to touch

#### ***Severe Symptoms***

Arched back  
Lameness  
Dragging legs  
Inability to stand  
Crying when touched or moved  
Trembling  
Staggering  
Partial or complete paralysis

### **What is the treatment for IVDD?**

In all cases the goal is to eliminate pressure on the spinal cord and inflammation in order to ensure the dog is pain-free and return to a fully mobile life. An examination by a vet is essential to ascertain precisely what is happening and will generally include a neurological exam, X-ray, and/or CT or MRI scan to locate the source of the spinal injury.

#### **Mild to Moderate Cases**

Where the diagnosis reveals only mild to moderate injury, i.e. pain and weakness, a course of medication and cage rest for four to six weeks should help followed by a slow return to normal activity.



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## Severe Cases

With these cases, if deep pain sensation and mobility has been lost this may mean that the connection from the brain to the body has been severely compromised and the only way to try to re-establish the connection is by surgery. In this instance, some dogs can fully recover after surgery while others will still have difficulties walking or remain paralysed. Unfortunately, dogs who have had an episode of IVDD and whose DNA test shows them to be carriers of CDDY often have more than one episode of IVDD throughout their lives.

Therefore, if you notice any of the above symptoms you must seek veterinary advice immediately as delay in surgery could severely compromise the outcome.

## **Which Breeds Are Most Susceptible?**

Certain breeds are more likely to get IVDD due to a disorder of their cartilage, these include:

- Bassett Hounds
- Beagles
- Bulldogs
- Corgis
- Cocker Spaniels
- Dachshunds (most common)
- Pekingese
- Poodles
- Shih Tzus

There are other breeds that although do not carry the CDDY gene are susceptible to IVDD these include:

- German Shepherds
- Labrador Retrievers
- Doberman Pinschers

## Prevention

There are some easy and practical things you can do to minimize the risk of IVDD in your dog(s):

- Keep your dog's weight down to reduce neck and back stress
- Use a harness when going on walks to reduce neck stress that can occur if using a neck leash.
- Minimize jumping on/off furniture by providing ramps or steps.
- Keep your dog mobile.



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## **Our recommendations**

IVDD is a very distressing condition not only for the owner but for the dog as well and should surgery be required can be very costly.

We would therefore recommend breeders should test for CDDY in all their breeding stocks and where possible only mate N/N (Clear) to N/N, or N/CDDY. Puppies from the mating of N/N to N/CDDY should also be tested and certificates be provided to the new owners at time of sale.

At no time should breeders consider taking N/CDDY dogs out of their breeding regime as we still only have a small gene pool in the UK, and this could have a detrimental effect on the overall health of our breed. Dogs whose test show them to be CDDY/CDDY should if possible be removed from your breeding regime.

We would like to reiterate that DNA testing for CDDY has only been available for our breed in the UK since 2018 and therefore it is too early to see any trends at this present time. Further research and testing need to be undertaken over the coming years to accurately see any trends developing.

It should also be noted that research in to whether there is a connection with dogs who have two copies of both CDPA and CDDY and if this could have an impact on dogs developing Intervertebral Disc Disease, is still ongoing.

*Source: UC Davis  
Animal Labs  
Handicap Pets*