

## NCL Description for Tibetan Terriers

**Age of onset of clinical symptoms:** 4 to 6 years

**Age of euthanasia:** 7 to 10 years

### **Abnormalities often observed by the owner:**

***Mental changes:*** A common sign of NCL in Tibetan Terriers is the development of aggressiveness toward people and/or other dogs. Dogs with this disorder often appear nervous or anxious. Changes in eating habits have also been reported. Affected dogs often lose the effects of both behavioral and house training.

***Changes in gait and posture:*** Early in the course of the disease affected dogs exhibit a mildly uncoordinated gait with occasional stumbling and crossing over. The lack of coordination becomes more severe as the disease progresses. Dogs with NCL often have difficulty jumping up onto surfaces from the ground or floor, and in going up or down stairs. In the end stage of the disease affected dogs fall over often and have difficulty getting back on their feet.

***Visual abnormalities:*** Impaired vision under dim light conditions, sometimes progressing to visual impairment under bright conditions late in the disease. Pupils may be slightly dilated.

***Seizures/convulsions:*** Mild seizures that are often unrecognized by the owner are common as the disease progresses. Severe seizures do sometimes occur as well.

### **Abnormalities observed upon clinical examination:**

***Clinical neurologic changes:*** Early in the course of the disease affected dogs exhibit a mildly ataxic gait with occasional stumbling and crossing over. The ataxia becomes more severe as the disease progresses. Tibetan Terriers with NCL often have difficulty jumping up onto surfaces from the ground or floor and in going up or down stairs. In the end stage of the disease affected dogs will fall over often and have difficulty getting back on their feet. There is also some degree of hypermetria in the thoracic limbs of the affected dogs. Stance in affected dogs is often wide-based. Proprioceptive positioning is brisk, but hopping and hemiwalking become abnormal, especially in the thoracic limbs. Mild seizures that are often unrecognized by the owner are common as the disease progresses. Severe seizures do sometimes occur as well.

***Clinical ophthalmic changes:*** Both direct and indirect pupillary reflexes are slower than normal in affected dogs. Affected dogs exhibit a slight mydriasis (dilation of the pupils).

***Visual abnormalities:*** Impaired vision under dim light conditions, sometimes progressing to visual impairment under bright conditions late in the disease.

***Retinal changes:*** Examinations of the eyes suggest a slowly progressive retinal degeneration that varies somewhat among individual dogs. Early signs of retinal degeneration include a slight increase in tapetal reflectivity in the midperipheral fundus as well as some attenuation of the retinal blood vessels peripherally. In some dogs a moderately advanced generalized retinal degeneration is observed by the end stage of the disease.

***Electroretinography (ERG):*** Significant retinal functional impairment is apparent in affected animals, particularly late in the course of the disease. Rod function is reduced by as much as 90% in dogs with NCL. Cone function, on the other hand, is not impaired in the affected dogs.

**Histopathology:** Massive accumulations of autofluorescent storage bodies occur throughout the central nervous system, including the cerebral cortex, cerebellum, and retina. The presence of the storage bodies in ganglion cells of the retina is reliably diagnostic. At the electron microscopic level, the structures of the storage bodies vary somewhat between tissues. However, the storage bodies always contain membrane-like inclusions.

**Mode of inheritance:** Autosomal recessive.

**Gene containing mutation:** Unknown.

**References:**

Riis RC, Cummings JF, Loew ER, de Lahunta A: Tibetan Terrier model of canine ceroid lipofuscinosis. *Am J Med Genet.* 1992;42:615-621.

Katz ML, Sanders DA, Sanders DN, Hansen E, and Johnson GS: Assessment of Plasma Carnitine Levels in Tibetan Terriers in Relation to Ceroid-Lipofuscinosis. *Am. J. Veterinary Res.* 63:890-895, 2002.

Katz ML, Narfström K, Johnson GS and O'Brien DP: Assessment of retinal function and characterization of lysosomal storage body accumulation in the retinas and brains of Tibetan Terriers with ceroid-lipofuscinosis. *Am. J. Vet. Res.*, in press, 2005.