

## NCL Description for Polish Lowland Sheepdogs (Polish Owczarek Nizinny, PON)

**Age of on-set of clinical signs:** 0.5 to 4.5 years

**Age of euthanasia:** 1.5 to 8 years

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

***Mental changes:*** Dog unhappy and anxious, appear not to hear or see normally, appear to have changes of senility, is often irritated, and now and then aggressive (may even bite owner). Reacts very strongly to unusual sounds.

***Changes in gait and posture:*** Progressive abnormal gait most marked in the hind legs with occasional crossing over and stumbling, difficulties in walking on a leash. In older affected dogs; unwillingness to move around, wants to stand along the wall.

***Visual abnormalities:*** Is uncertain and bumps into things in the dark, can have slight problems also in the light. Does not appear to follow moving objects normally with the eyes.

***Other changes:*** Skin problems are common in affected dogs (often related to thyroid dysfunction, see below).

### **Abnormalities observed upon clinical examinations:**

***Clinical neurologic changes:*** Conscious proprioception and hopping reactions may be delayed in the pelvic limbs and occasional crossing over of the hind limbs are seen. Spinal reflexes and cranial nerve examinations are usually normal.

***Clinical ophthalmic changes:*** Abnormal pupillary light reflexes; resting pupillary diameters abnormally wide in room light, and do not contract normally upon strong light stimulation (slow reactions and contractions are not complete).

***Visual abnormalities:*** Can usually see a falling object (cotton ball) but does not follow it all the way to the floor.

***Retinal changes:*** Early changes are usually observed in 1-2 year-old dogs but fundi can be normal appearing in some individuals up to the age of 3-4 years. Most often changes are observed in the form of pale gray spots initially but with time brownish spots are seen marked in the central fundus, spreading into the periphery with increasing age. As the spots become more marked there is a concomitant vascular attenuation. In older affected dogs the retina becomes atrophic/hyperreflective, with large amounts of hyperpigmented lesions spreading into the periphery.

***Electroretinography (ERG):*** The process of dark adaptation is often abnormal and there are reduced amplitudes mainly of the rod but sometimes also of the cone visual systems. ERG changes are extremely variable (from near normal to grossly abnormal) in affected dogs.

***Other clinical findings:*** Dermatitis not uncommon in affected dogs, often found in conjunction with reduced thyroid function (see below).

### **Histopathology**

***Brain:*** Gross examination shows light brown discoloration of the brain. By light microscopy intracytoplasmic storage of small granulae are seen in neurons that are PAS, Luxol fast blue and Sudan black positive. Storage bodies also exhibit autofluorescence. By electron microscopy the storage bodies are membrane-bound

organelles of various sizes, and there are whorls of intracytoplasmatic, finger-print-like material.

**Eyes:** Membrane-bound inclusions are found in neuronal cells of the retina, most prevalent in the ganglion cells. Changes are also observed in the retinal pigment epithelium (RPE). In the former, the inclusion bodies can be either granular, more homogenous or finger-print like. In the RPE mainly finger-print like or tubular material is seen in the inclusions, which can become up to 7 microns in diameter (not seen in normal aging dogs). The material in neuronal and RPE cells stain positive with PAS and emits autofluorescence.

**Other organs and structures:** Storage of inclusion bodies may be seen also in lymph nodes, liver, kidney and skin of some affected dogs. Lymphocytic thyroiditis and thyroid atrophy is often seen in conjunction with NCL of PON dogs.

**Mode of inheritance:** Autosomal recessive inheritance is suspected.

**Gene containing mutation:** Unknown

**References:**

Narfstrom, K: Neuronal ceroid lipofuscinosis in the PON dog: Clinical, electrophysiological and morphological findings. *Abstract book of International Society of Veterinary Ophthalmology and Meeting of the Voorjaarsdagen*, Amsterdam, April, 1995.

Wrigstad, A., Nilsson, S.E.G., Dubielzig, R and Narfstrom, K.: Neuronal ceroid lipofuscinosis in the Polish Owczarek Nizinny (PON) dog. A retinal study. *Doc Ophthalmol* 91: 33-47, 1995