



## Lymphoma and the Cranial Nerves

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### Abstract

Enlargement of peripheral nerves is unspecific and can occur in inflammation, different types of nerve tumors and in malignancies. This contribution aims to describe the involvement of cranial nerves conjunction with lymphoma by different mechanisms.

As tumorous involvement of CN in lymphoma is rare, only small case series, individual case reports and summaries can be used as sources.

**Keywords:** Cranial nerves; lymphoma; Mechanisms

### Introduction

Tumorous involvement of cranial and peripheral nerves caused by lymphoma is rare. The involvement of the meningeal space and dura by tumors is not considered here, although synchronous combinations of meningeal and extrameningeal involvement have been observed. Tumors of the Cranial Nerves (CN) have a wide clinical spectrum, as their symptoms go beyond sensorimotor function, or neuropathic pain and may involve other senses and functions. For diagnosis MR and PET studies, as well as nerve ultrasound are increasingly used. Lesions of CN in lymphoma patients can be classified with regard to time, causality and distribution. This review focuses on tumorous enlargement of cranial nerves caused by lymphoma.

### Cranial Nerve Involvement

Cranial nerve involvement in lymphoma is not homogenous and ranges from compression to focal invasion, to different types of parenchymatose involvement, and also antero- and retrograde spread can occur. Interestingly also anastomoses between nerves can serve tumor spread from one nerve distribution into the other (examples: CN V and VII, cervical plexus and occipital nerves). Specific spread restricted to CN and peripheral nerves is termed neurolymphomatosis [1] and also endovascular spread occur in intravascular lymphoma [2]. The histologic type of lymphomatous involvement is not homogenous and ranges from compression/invasion to different types of endo-, peri- and epineural distribution.

Tumorous enlargements of CN are usually caused by B cell lymphomas. Any region of the skull as the base of the skull [3], the cavernous sinus, the ganglion Gasseri [4], the mandibula, the orbit and other cavities of the skull and also the regions of the neck can be involved. A combination with Leptomeningeal Spread (LC) can occur, and is likely if CN are enlarged within the leptomeningeal space. Dural involvement is rare.

### Investigations

In addition to clinical neurology and electrophysiology, increasingly imaging as MRI including tractography and spectroscopy, PET and nerve US are used. Often a biopsy is needed to confirm the suspicion. Additional CSF studies are needed, and can serve a further classification of lymphoma. However CN involvement by lymphoma, does not necessarily involve the meninges. However swelling and local enlargement of CN can be caused by a variety of other conditions. In lymphoma can appear at any stage of the disease, either as a presenting sign, during the course or as recurrence.

### Lymphoma and Cranial Nerves

The orbit and the optic nerve can be involved [5] in 1 % of lymphomas. Both the orbit, the eye and adjacent structures can be involved [6] and the optic nerve can be an isolated manifestation

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of lymphoma [7]. Involvement of the cavernous sinus [8], the adjacent sinus [9], the clivus [10] have to be distinguished from other intracranial tumors, in particular meningioma. Perineurial spreading of lymphoma in the cavernous sinus has been described [11]. Individual enlargement of the oculomotor nerve has been observed [12,13] also in Hodgkin's disease [14] and in the trochlear nerve [15]. Similar to the optic nerve and orbit, the trigeminal nerve seems to be frequently involved. It can present as nerve enlargement [16], enlargement of Meckel's cave [17], or as mental neuropathy [18,19] also with infiltration of the mandible [20]. Isolated motor lesions of the trigeminal nerve can occur and can also be caused by infiltration of masticatory muscles [21]. Hearing loss by local lymphoma has been described [22] and also middle ear lymphoma can be a presentation [23]. Rarely the vestibular nerve is involved [24], or affection of individual canals [25] has been observed. The caudal cranial nerves seem to be rarely affected. For the glossopharyngeal and accessory nerve. Hoarseness and swallowing difficulties are the presenting symptom [26].

Enlargement of the vagus nerve has been observed [27,28]. Lesions of the hypoglossal nerve are rarely observed with bilateral nerve thickening [29] and another observation reports an associated occipital neuralgia [29] probably due to affection of the cervical plexus. Lymphoma can also present with multiple cranial nerve lesions [31,32].

As differential diagnostic possibilities several inflammatory conditions and also post radiation fibrosis [33] and neurotoxicity [34,35] in previously treated patients need to be considered.

## Discussion

Cranial nerve lesions in lymphoma can appear at various stages of the disease and are caused by several mechanisms. Although meningeal and CN involvement is a frequent presentation of lymphoma also several other neoplastic mechanisms have to be considered, ranging from dural involvement, to spread in the base of the skull, the cavities and the soft tissue of the head and neck. Individual CN involvement seems to be frequent for the optic nerve, the oculomotor and the trigeminal nerves, whereas caudal CN involvement seems rare. Clinically also symptomatic painful presentations by trigeminal nerve lesions, or tumorous lesions of the cervical plexus and occipital nerves projecting with pain in the head occur. Before treatment also unrelated conditions or late effects of previous treatments need to be considered. The precise identification of the lesions, determines the best available treatment and needs to be carefully chosen.

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