

Case Study

Role of Magnetic Resonance Imaging in Herpes Zoster Ophthalmicus Ophthalmoplegia

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ABSTRACT

Aims: To hypothesise the mechanisms of herpes zoster ophthalmicus (HZO) related ophthalmoplegia by magnetic resonance imaging (MRI).

Case presentation: A 61-year-old Chinese man diagnosed with right sided HZO with positive Hutchinson's sign, subsequently developed right eye complete ptosis, mydriasis and limitation of elevation 1 month after HZO. MRI showed thickening and enhancement of right oculomotor nerve and enhancement of right extraocular muscles. CSF revealed leukocytosis and positive VZV DNA without any clinical signs of meningitis. The diagnosis HZO-related ophthalmoplegia and asymptomatic VZV meningitis was made based on the clinical and laboratory findings. The external ocular muscle palsies of this patient were due to both oculomotor nerve palsy and orbital myositis demonstrated by MRI.

Conclusion: The pathogenesis of ophthalmoplegia associated with HZO is attributed by multiple factors such as neuritis of the cranial nerve and orbital myositis which can be diagnosed with MRI.

Keywords: Ophthalmoplegia, Herpes Zoster Ophthalmicus, Magnetic Resonance Imaging

1. INTRODUCTION

Herpes zoster (HZ) is caused by reactivation of latent varicella zoster virus (VZV) in cranial-nerve or dorsal-root ganglia, with spread of the virus along the sensory nerve to the dermatome. The lifetime risk of HZ is estimated to be 10% to 20% in Caucasian population, which increases in elderly and immunocompromised people^[1,2]. Herpes zoster ophthalmicus (HZO) is a term used when HZ affects the ophthalmic division of the fifth cranial nerve. Ocular manifestations occur in approximately 50% of HZ patients, which can involve all ocular structures without the use of antiviral therapy^[3]. Neurological complications such as ophthalmoplegia are reported in 5% to 31% of HZO patients^[4-6], the third cranial nerve palsy being the commonest and the fourth cranial nerve palsy being the least^[7]. The pathogenesis of ophthalmoplegia complicating HZO remains controversial. HZO-related ophthalmoplegia is traditionally interpreted as perineuritis of the third, fourth and sixth cranial nerves in analogy to optic neuritis. However, patients with HZO and ophthalmoplegia previously classified as cranial nerves palsies might have also been diagnosed as having ocular myositis confirmed with CT (Computed Tomography) or MRI^[8]. However, such cases as ophthalmoplegia complicating HZO with MRI confirmed neuritis of the cranial nerve and myositis of the extraocular muscle have rarely been reported^[9].

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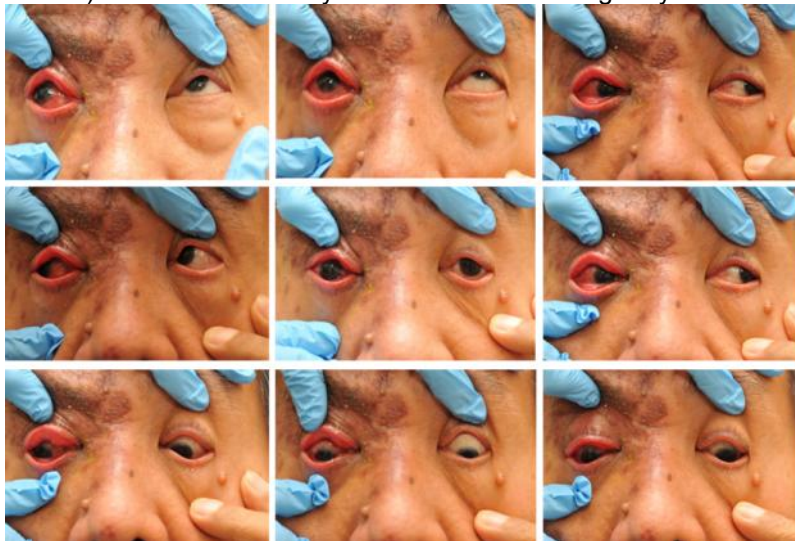
2. CASE PRESENTATION

A 61-year-old Chinese man with a history of chickenpox at childhood developed sharp, lancinating pain over the right side of the scalp. The patient is immunocompetent without significant medical history. After 3 days, multiple painful vesicular eruptions were noted on the right side of the forehead and eyelid, accompanied with right eye foreign-body sensation and epiphora. The patient's uncorrected Snellen visual acuity was 6/9 in both eyes. Ophthalmic examination showed multiple vesicles over the distribution of the ophthalmic division of the trigeminal nerve on the right side of forehead, eyelid with positive Hutchinson's sign (skin lesion on the tip of the nose), right eye upper lid edema, blepharitis, mild conjunctival injection, dendritic ulcer with full extraocular movements and intact corneal sensation. The patient was diagnosed to have HZO-related blepharoconjunctivitis, epithelial keratitis and dermatitis, and was started on oral acyclovir 800mg 5 times a day for two weeks, 3% acyclovir eye ointment 5 times a day, topical moxifloxacin 4 times a day and 5% acyclovir skin ointment 3 times a day for 3 weeks. One month after the initial presentation, the patient reported that he was unable to open the right eye. Ophthalmologic examination revealed right eye complete ptosis with significant crusting scarring over the involved periorbital and nasal skin lesion (Fig.1).



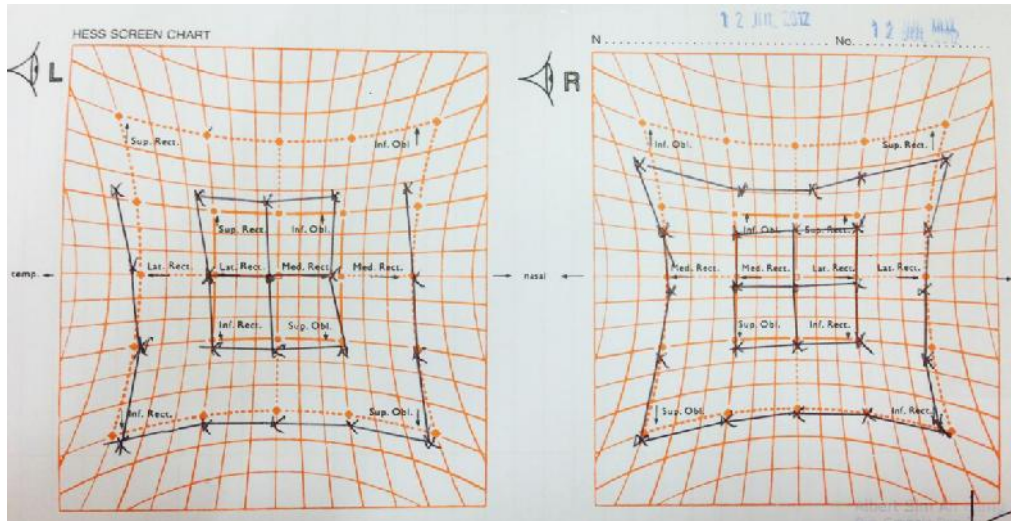
Fig.1 The overview: Right eye crusting scarring over the distribution of the ophthalmic branch of the trigeminal nerve and positive Hutchinson's sign with complete ptosis

The pupils were anisocoric (Right: 5mm, Left: 3mm) and unequally reactive to light (Right: sluggish, Left: brisk). Extraocular motility showed limitation of right eye's elevation (Fig. 2).



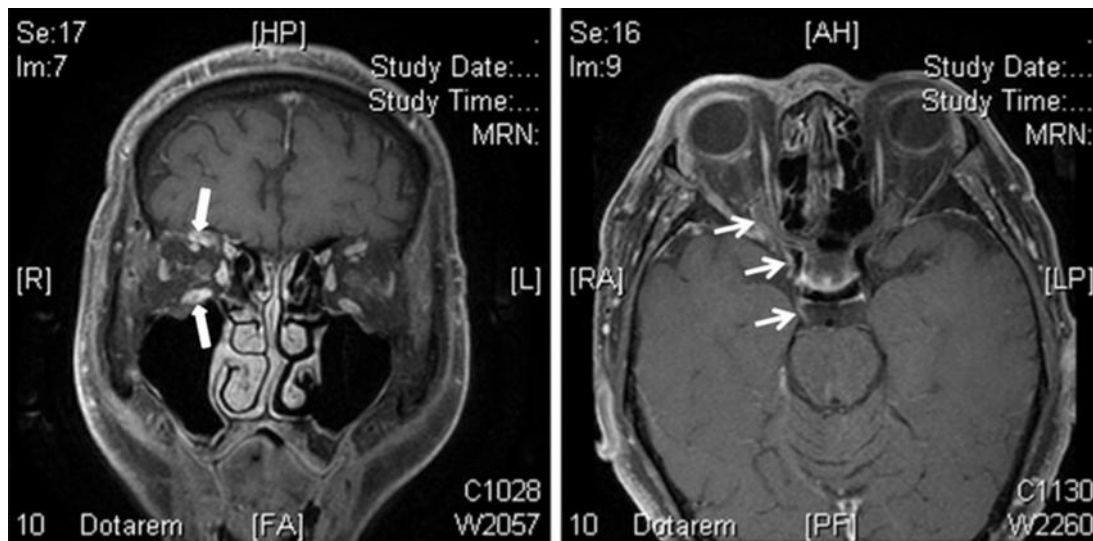
62 **Fig.2 Nine gaze eye positions:** The range of eye motion of the cardinal position revealed
63 limitation of right eye elevation and overelevation of the left eye
64

65 The Hess screen charts demonstrated underaction of the right superior rectus and inferior
66 oblique muscle with overaction of the left superior rectus and inferior oblique muscle (Fig. 3).
67



68 **Fig.3 Hess screen test:** Paresis of the right superior rectus and inferior oblique muscle with
69 overaction of the left inferior oblique and superior rectus muscle
70
71

72 Other cranial nerve functions were normal except mild hypoaesthesia over the distribution of
73 the ophthalmic division of the trigeminal nerve on the right side. MRI of the anterior visual
74 pathway showed enhancement and thickening of the cisternal, intracavernous and
75 intraorbital portions of the right oculomotor nerve and enhancement of right extraocular
76 muscles especially superior rectus and inferior rectus muscle (Fig.4).
77



78 **Fig.4 Post-contrast T1-weighted coronal and axial MRI:** A) Enhancement and thickening
79 of the right-sided extraocular muscles especially the superior rectus and inferior rectus
80 muscle (wide arrow) B) Enhancement and thickening of the cisternal, intracavernous and
81 intraorbital portions of the right third cranial nerve (narrow arrow).
82

Cerebrospinal fluid (CSF) analysis by lumbar puncture yielded a slight leukocytosis (19 white blood cells/mm³) with positive polymerase chain reaction (PCR) result for VZV. The diagnosis HZO-related ophthalmoplegia and asymptomatic VZV meningitis was made based on the clinical and laboratory findings. The external ocular muscle palsies of this patient were due to both oculomotor nerve palsy and orbital myositis demonstrated by MRI. Then acyclovir 750mg was given intravenously for 2 weeks. At a follow-up examination 8 weeks later, complete resolution of ophthalmoplegia with full extraocular movement was found in this patient and oral gabapentin was prescribed for postherpetic neuralgia (PHN).

3. DISCUSSION

Ophthalmoplegia associated with HZO is not uncommon. Extraocular muscle palsies usually appear 2 to 4 weeks after a rash, but sometimes occur simultaneously with a rash or more than 4 weeks later. It is a transient, self-limited condition which is rarely seen under the age of 40^[7,10].

The pathogenesis of the extraocular muscle palsies complicating HZO remains controversial. It is traditionally assumed that ophthalmoplegia in HZO occurs due to neuritis of the third, fourth and sixth cranial nerves in analogy to optic neuritis^[11]. *Carroll et al* hypothesized that the demyelinating process seemed likely to be responsible for the reversible optic neuropathy, and ocular motor and cerebellar abnormalities in HZO^[12]. *Marsh et al* also described a retrograde spread of the virus from the trigeminal ganglion to the fifth nerve nucleus reaching other cranial nerve^[7]. However, so far, lesions of the III, IV, or VI cranial nerves in ophthalmic zoster have never been verified pathologically or MR-tomographically in the previously reported cases and, consequently, the pathogenesis of the external ocular muscles palsies in ophthalmic zoster is still unclear^[8, 11].

Before the advent of CT and MRI, VZV-induced ocular myositis was an important differential diagnosis to inflammatory involvement of the third, fourth, and sixth cranial nerves in HZO-related ophthalmoplegia though without the aid of imaging^[7]. *Volpe et al* described a case of an orbital myositis with enlargement of the muscle bellies of several ocular muscles shown by CT findings^[13]; *Kawasaki et al* reported a patient of orbital myositis preceding vesicular eruption with enlargement and enhancement of extraocular muscles consistent with an inflammatory myopathy shown by MRI^[14]; *Krasnianski et al* described a patient with ophthalmic zoster and external ophthalmoplegia due to ocular myositis demonstrated by MR imaging^[8]; *Badilla et al* reported a case of orbital myositis involving the oblique muscles with CT showing massive superior and inferior oblique enlargement and moderate enlargement of the remaining extraocular muscles with tendon sparing^[15].

Based on the clinical findings of our patient (limitation of right eye elevation, dilated pupil), both superior and inferior divisions are involved, which correlates with the enhancement of the oculomotor nerve along the cisternal, intracavernous and intraorbital portions shown in MRI. However, significant limited depression was not detected in this patient, which cannot be completely explained by the 3rd cranial nerve palsy. Thus, other aetiology may exist. Interestingly, in our patient MRI not only showed thickening and enhancement of right oculomotor nerve suggestive of neuritis, but also enhancement of ipsilateral extraocular muscles considering acute orbital myositis. Nevertheless, how orbital myositis contributed to the questionable eye movement in our patient remains unknown. To our knowledge, there's little evidence which supports the hypothesis that HZO-associated ophthalmoplegia may involve multiple mechanisms. Therefore, our case clinically demonstrates different pathogenesis concurrently might contribute to extraocular muscle palsies in HZO.

131 It is reported that administering acyclovir during the early phase of HZO should be initiated to
132 prevent further ocular complications. However, there are no sufficient data to support
133 treatment of HZO-associated ophthalmoplegia. Since the recovery of the cranial nerve palsy
134 following HZO is found to be usually full even for complete ophthalmoplegia^[16], the necessity
135 for any specific treatment for ophthalmoplegia is equivocal^[17]. However, systemic antiviral
136 treatment with corticosteroids has been recommended for complete ophthalmoplegia with
137 optic nerve dysfunction which suggests orbital apex syndrome (OAS) to improve visual
138 prognosis. On the other hand, an empirical treatment of 15 to 30 mg of acyclovir per
139 kilogram of body weight for 10 days has been suggested for HZ-associated
140 meningoencephalitis^[18]. Subclinical invasion of VZV into the central nervous system (CNS) is
141 relatively common, with approximately one-third of asymptomatic immunocompetent patients
142 having a CSF PCR positive for VZV and 46% of patients demonstrating CSF leukocytosis
143 without any clinical signs of meningitis^[19]. Furthermore, abnormal CSF is slightly more in
144 HZO patients with ophthalmoplegia (88%) than those without it ^[20]. In our case,
145 asymptomatic VZV meningitis was confirmed by CSF results, so we started acyclovir
146 intravenously once the diagnosis was made.

147 **4. CONCLUSION**

148 Patients with HZO and ophthalmoplegia are not uncommon. The pathogenesis of
149 extraocular muscle palsy is attributed by multiple factors such as neuritis of the cranial
150 nerve, orbital myositis which might be detected as MRI or CT is performed.

151

152 **COMPETING INTERESTS**

153 Authors have declared that no competing interests exist.

154 **AUTHORS' CONTRIBUTIONS**

155 Author A wrote the first manuscript and managed the literature search. Author B provided
156 the case, reviewed and modified the manuscript. All authors read and approved the final
157 manuscript.

158 **CONSENT**

159 All authors declare that written informed consent was obtained from the patient for
160 publication of this case report and accompanying images. A copy of the written consent is
161 available for review by the Editorial office/Chief Editor/Editorial Board members of this
162 journal

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