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Role of video head impulse test to indentify the site of lesion in patients with vestibular neuronitis

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ABSTRACT

Background: Vestibular neuronitis is one of the common causes of peripheral vertigo. Mostly the diagnosis of this entity is on clinical grounds. With the advent of video head impulse test (VHIT), assessment of function of all the semicircular canals has been possible based on principle of vestibulo-ocular reflex (VOR). The rationale of our study was to identify the affected branch of vestibular nerve in cases with clinical suspicion of vestibular neuronitis by measuring VOR gain and saccades using VHIT.

Methods: This was a retrospective study carried out in the Department of ENT, Head & Neck Surgery of Institute of Medicine, Kathmandu, Nepal. Record files of patients who attended OPD between October 2017 to October 2018 with the clinical diagnosis of peripheral vestibular neuronitis were assessed. A total of 13 cases were included in the study. VHIT records of the cases were assessed for VOR gain and saccades. Normal contralateral canals were taken as control. Paired t-test was used to compare the statistical significance of gain asymmetry and presence of saccades between the affected side and normal side.

Results: Of 13 cases, 11 had isolated involvement of lateral semicircular canal and 2 cases had isolated involvement of posterior semicircular canal. Average gain was 0.68 in both groups. Presence of overt and covert saccades was seen in all the affected canals.

Conclusions: VHIT, in cases with vestibular neuronitis, is a good test not only to confirm the diagnosis but also to identify the division of vestibular nerve involved.

Keywords: Vestibular neuronitis, Vestibular nerve, Video head impulse test

INTRODUCTION

Vestibular neuronitis is one of the commonest entities causing vertigo. Inflammation of vestibular nerve from viral infection results in a characteristic rotatory vertigo which may last for several days in the absence of cochlear symptoms such as decreased hearing and tinnitus. Considering the pathology in the vestibular nerve, vestibulo-ocular reflex (VOR) is affected in most of the patients and is one of the key elements to be examined in these cases.1

The vestibular system is supplied by the superior and inferior vestibular nerve. Superior vestibular nerve supplies urticle, superior and lateral semicircular canal and the inferior vestibular nerve supplies the saccule and posterior semicircular canal. Whichever branch is involved by the inflammation, the general clinical picture usually remains the same. With the advent of video head impulse test (VHIT), it is possible to measure the VOR gain of semicircular canals and the saccadic eye movements.^{2,3} The rationale of our study was to identify the affected branch of vestibular nerve in cases with clinical suspicion of vestibular neuronitis by measuring VOR gain and saccades using VHIT.

METHODS

This was a retrospective study carried out in the Department of ENT, Head & Neck Surgery of Institute of Medicine, Kathmandu, Nepal. Record files of patients who attended OPD between October 2017 to October 2018 with the clinical diagnosis of vestibular neuronitis were assessed. A working definition for vestibular neuronitis was given as an acute onset rotatory vertigo lasting more than 24 hours associated with or without nausea and vomiting in the absence aural symptoms such as decreased hearing, tinnitus and aural fullness. Cases with incompletely documented history and cases with vertigo of other causes were excluded. All test and treatment procedures were carried out at arm length following the Declaration of Helsinki 1964.⁴

Caloric test has limitation in acute care setting, like in acute vestibular neuronitis attacks. Also, the caloric responses may be reduced in cases with stroke involving the AICA surrounding area. Having several such limitations as well as a limited role in topodiagnosis, head impulse test was used as diagnostic test for the acute cases as vestibular neuronitis in this study.⁵

During data collection, following data were collected retrospectively: date of admission, age, gender, VHIT findings of gain of the different semicircular canal (SCC) and saccades. Head impulse test was carried out using otometrics ICS impulse otosuite vestibular V 1.2. Average gain was calculated using software used averaging of individual gains in velocity between 140°/s to 180°/s. The norms used in this study were as 0.8 for horizontal canal and 0.7 for all other SCC.⁶ Any value

below this were considered as pathological. Refixation saccades within 200 ms after head impulse was considered for evaluation and validation of decreased gain. Superior branch of vestibular nerve was considered to be involved if test for lateral and/or superior semicircular canal showed reduced gain and/or presence of saccades. Similarly, inferior vestibular nerve was considered to be involved if test for posterior semicircular canal showed reduced gain and/or presence of saccades. Semicircular canals of the unaffected ears were taken as control. VHIT was carried out after 7 days of onset of symptoms. Audiological evaluation was carried out using amplaid A177 diagnostic audiometer in a sound treated two room setup following ANSI standards. Audiological evaluation was carried out to rule out other causes of acute vertigo as labrynthitis, Meinere's disease etc.

Statistical analysis was done using SPSS software version 20. Paired t-test was used to compare the statistical significance of gain asymmetry and presence of saccades between the affected side and normal side. We considered p value of <0.05 as statistically significant.

RESULTS

Thirteen cases were included in the study of which 7 were male and 6 were female. Age distribution of the cases is shown in Table 1.

Table 1: Age distribution.

Age group (in years)	Number of cases
<25	2
25-50	5
>50	6

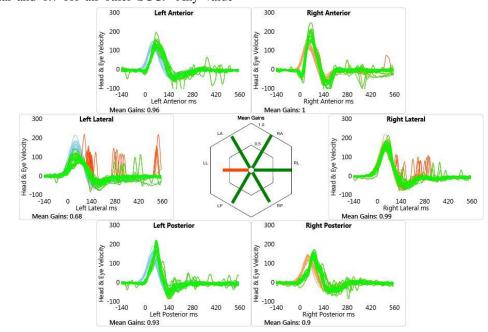


Figure 1: VHIT showing reduced gain and presence of overt saccades in left lateral semicircular canal.

Table 2: Average gain of affected semicircular canals and their comparison with the normal counterparts.

Semicircular canals	Number of affected cases	Average gain on affected side	Average gain on normal side	Paired t test (p value)
Posterior	2	0.68	0.93	0.395
Lateral	11	0.68	0.86	0.101
Posterior and lateral	13	0.68	0.87	0.047

All the cases had reduced gain and presence of saccades in the affected site on video head impulse test. In only 2 cases the posterior canal of the affected ear showed reduced gain with presence of saccades. In the rest of the cases lateral semicircular canal of the affected ear showed similar findings (Figure 1). Average gain of the affected posterior canal when compared to their normal counterpart didn't show statistical significance. Similar was the result for lateral semicircular canal. However, comparison of average gain of all affected semicircular canals with their normal counterparts yielded statistical significance (Table 2).

All affected canals showed presence of saccades, predominantly overt saccades with mean of 0.61 and covert saccades with mean of 0.11. The presence of saccades was found to be statistically significant with p value of <0.05 using paired t-test.

DISCUSSION

Vestibular neuronitis is the inflammation of vestibular portion of eighth nerve and is usually considered of viral origin. Superior vestibular nerve has more propensity to be affected by inflammation than the inferior. The entity is considered third most common cause of vertigo following BPPV and Meniere's disease. With no sex predilection, it is commonly seen in middle aged population. The oldest case reported was aged 73 and the youngest, aged 15.8 In our study, there was almost equal predilection in both male and female and majority of the cases were in their 5th decade of life.

Before the advent of VHIT, vestibular neuronitis was more of a clinical diagnosis, relying on features of acute onset vertigo, without cochlear symptoms. However, certain neurological conditions may mimic vestibular neuronitis such as vertibrobasillar insufficiency and multiple sclerosis and it is not uncommon for clinicians to miss the diagnosis.8,9 VHIT works on the principle of VOR and can measure the function of all semicircular canals. By measuring the average VOR gain of semicircular canals and detecting the presence of saccades, we can easily detect the labrynthine hypofunction. Being a fast and repeatable procedure, with ability to detect even mild canal hypofunction and not being affected by the age, VHIT is being established as one of the primary tests for patients with vesibular disorders.2,10

VOR gain, one of the measures of VHIT, is the ratio of velocity of head movement to the velocity of eye movement. In normal instances, the velocity of eye movement should be equal and opposite to velocity of head movement and thus, the normal VOR gain being 1. In the patients with vestibular dysfunction, VOR gain is reduced as the eye movements are slow and don't match the head movement. In order to fixate eyes to the target, corrective saccades occur. The catch-up saccades not detected clinically are "covert" saccades and those detected clinically are "overt" saccades. In our study, we considered gain up to 0.8 for horizontal canal and 0.7 for all other canals as normal.⁶ In 11 cases, only the lateral canals were affected, signifying the involvement of superior vestibular nerve. The rest 2 cases had isolated involvement of posterior canal, signifying the involvement of inferior vestibular nerve. Average gain was 0.68 in both groups, which was reduced in comparison with their normal counterparts however, insignificant. Presence of saccades, statistically predominantly overt, was seen in all affected canals. Guan et al. in their study yielded similar results. 11 Of the total cases with vestibular neuronitis in their study, 22 cases had isolated lateral canal involvement and 7 cases had isolated posterior canal involvement. Two cases had both lateral and posterior canal involvement. When compared to the normal control, the VOR gain asymmetry was found to be statistically significant. Similarly, results of study by Taylor et al was also in accordance to ours where majority of the cases with vestibular neuronitis showed involvement of superior vestibular nerve when evaluated with VHIT and VEMP tests.¹² In a report by Yacovino et al of a case with bilateral vestibular neuronitis, the superior vestibular nerve was found to be involved bilaterally on VHIT. There was a reduction of VOR gain in bilateral lateral and anterior canals with posterior canal VOR gain being normal.¹³ Isolated involvement of inferior vestibular nerve in vestibular neuronits is very rare. In a retrospective review by Kim et al, only 9 cases of 703 patients with vestibular neuronitis were found to have affected inferior vestibular nerve. VHIT tests showed reduced gain of posterior canal with presence of corrective catch-up saccades.In seven cases there was abnormal c-VEMP.14

Major limitation of our study was a small sample size. Also for topographical diagnosis, application of VEMP would have further strengthened our findings. A prospective study of a large sample size with the

application of both VHIT and VEMP can be done to yield more conclusive results.

CONCLUSION

VHIT is undoubtedly a very useful investigation of choice in cases with vestibular neuronitis for confirming the diagnosis as well as indentifying the division of vestibular nerve involved. Addition of VEMP can further strengthen the diagnosis.

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Institutional Ethics Committee

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