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SHORT COMMUNICATION

Hess Lancaster screen test with the head tilted: A useful test in the diagnosis of bilateral fourth nerve palsies

A. ARMESTO[1,2], M.C. UGRIN[1], E. TRAVELLETTI[1], A. SCHLAEN[1], N. PIANTANIDA[1]

[1]Ophthalmology Department, Hospital de Clínicas, University of Buenos Aires
[2]Ophthalmology Department, Hospital Alemán, Buenos Aires - Argentina

PURPOSE. *To introduce Hess Lancaster screen test performed with the head tilted as a new ancillary test to help in the diagnosis of bilateral superior oblique (SO) nerve paresis.*
METHODS. *Three patients with clinical diagnosis of acquired bilateral fourth nerve paresis, three with clinical diagnosis of acquired unilateral fourth nerve paresis, and three normal subjects were tested with Hess Lancaster test in the nine positions of gaze with their heads straight and with their heads tilted to each side. Test results were compared and data were analyzed.*
RESULTS. *Hess Lancaster test of all patients with bilateral SO palsy performed with their heads straight showed unilateral SO underaction, but when the test was carried out with the head tilted to each side findings were positive for ipsilateral SO underaction and ipsilateral hypertropia for both sides. In those patients with unilateral SO palsy, Lancaster test was positive for SO underaction when the head was in straight position and when it was tilted to the side of the paretic muscle, but it was almost normal with the head tilted to the opposite side. Normal subjects did not show any abnormality regardless of the head position.*
CONCLUSIONS. *Bilateral SO palsies are sometimes difficult to diagnose for they might be masked. Hess Lancaster test carried out with the head tilted to both sides could help in the diagnosis of bilateral SO palsies. (Eur J Ophthalmol 2008; 18: 278-81)*

KEY WORDS. *Hess-Lancaster screen test, Bilateral superior oblique palsy, Head tilted, Masked superior oblique palsy, Fourth nerve*

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INTRODUCTION

The third step of the Parks three step test for diagnosing vertical deviations is the Bielschowsky head tilt test. It consists of the evaluation of the deviation on head tilt, and is useful to examine the action of the extraocular muscles involved in the vestibulo-ocular reflex (VOR) that triggers off if the head is tilted. The aim of this counter-rolling reflex is to keep the image straight when the head is leaned.
When the head is tilted to the right, the right superior oblique muscle (RSO) and the right superior rectus (RSR) receive excitatory inputs, and the right inferior oblique (RIO) and the right inferior rectus (RIR) are inhibited. The SO produces intorsion of the eye, but as it is also a strong depressor, the SR is needed to prevent hypotropia and neutralize vertical deviation. At the same time, opposite events take place in the left eye, the LIO and the LIR contract causing the excyclotorsion of the eye, and the LSO and the LSR are inhibited (1).
Traditional teaching states that when there is a unilateral SO palsy (uSO), hypertropia increases when the head is leaned to the paretic side by means of the normal SR action. In case of bilateral superior oblique palsy this phenomenon would happen in both eyes, leading to a bilaterally positive Bielschowsky head tilt test; that is, alternating hypertropia when the head is leaned to each side.
However, bilateral superior oblique (bSO) palsy is sometimes a

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difficult diagnosis to make. Its presentation may be variable and asymmetric. Some bSO palsies seem to be unilateral because SO palsy in one side is masked and does not become evident until the first eye is surgically treated (2).

The Hess-Lancaster screen test (HLST) is useful to diagnose ocular motility disorders in patients with normal sensory status. It evaluates the isolated movements of each eye by means of dissociating binocular vision with red and green filters, and good fusion potential is mandatory to obtain reliable results. It is usually performed with the head still and straight (3).

We carried out the HLST with the head straight and tilted to both sides in nine subjects: three normal subjects, three patients with clinical diagnosis of unilateral fourth nerve palsy, and three with clinical diagnosis of bilateral fourth nerve palsy.

MATERIALS AND METHODS

Three groups were defined for this study: three normal subjects (N group), three patients with uSO palsy (U group), and three patients with bSO palsy (B group). All subjects had normal sensory status and all patients with SO palsy complained of diplopia. Full ophthalmologic examination was performed in all of them. Ocular motility evaluation consisted of performing alternate prism and cover tests in the nine positions of gaze, Bielschowsky head tilt test, evaluations of ductions and versions, and Maddox double rod testing. SO palsy was diagnosed based on the Parks three step test, the assessment of unilateral oblique dysfunction (inferior oblique overaction, superior oblique underaction, or both) and the presence of subjective or objective excyclotorsion. Bilateral cases had to satisfy these criteria for both eyes.

The HLST was carried out in all patients with the head straight and with the head tilted to the right and to the left. First the examiner held a green filter flashlight that projected a horizontal streak and the patient held a red filter flashlight. The patient was asked to superimpose the streak to the examiners, and the nine diagnostic positions of gaze were analyzed, then the flashlights were switched and the test was repeated. All patients were tested in the first place with their heads straight, and after that they were asked to lean their heads about 30-45 degrees to the right and to the left in order to perform HLST again for each position. The size of head tilt was measured using a goniometer.

The tests results were compared and data were analyzed using chi square formula.

RESULTS

The three normal subjects showed no deviation when tested with HLST with their heads straight, nor when the test was carried out with their heads tilted.

Regarding the three patients with uSO palsy, when HLST was performed with the head straight we found hypertropia of the affected eye, underaction of the paretic SO, and slight overaction of the ipsilateral IO muscle. When the test was conducted with the head tilted to the paretic side, the following findings were disclosed: increase of vertical deviation in the affected eye, underaction of the paretic SO becoming more noticeable, overaction of the opposite IR, and no overaction of the contralateral SR noted. Vertical deviation decreased when the test was carried out with the head leaned to the unaffected side and it was closer to normality (Fig. 1).

Regarding the patients with bSO, when the HLST was conducted with the head straight, the asymmetric SO underaction became apparent and a slight hypertropia was found. When the test was performed with the head tilted to the side of the hypertropic eye, vertical deviation and excyclotropia increased. When the head was tilted to the other side hypertropia reversed, so the previously hypotropic eye turned hypertropic (Fig. 2).

During Bielschowsky head tilt testing the three patients had small amounts of vertical deviation when it was measured with prism cover test, but when HLST was performed on head tilt, the reversal of hypotropia became more evident.

We compared the results obtained with the HLST performed with the head tilted between groups. The test performed with the head straight was used as reference. If hypertropia increased when the head was leaned, it was considered a positive result and when vertical deviation was equal or smaller, a negative result. The normal subjects showed only negative results because they never showed deviation regardless of the position of their heads. Patients with uSO palsy had positive results when the test was carried out with the head leaned to the paretic side, and negative results when the head was tilted to the healthy side. Finally, the patients with bSO palsy had positive results no matter which position of the head was adopted to perform the test.

Chi square formula was used to analyze data. When N group was compared to U group the difference was statistically significant with a chi square of 4.2 for a critical value of 3.841. When N and B groups were compared a significant difference was obtained with a chi square of 12 for a critical value of 10.828. When groups U and B were compared, statistically

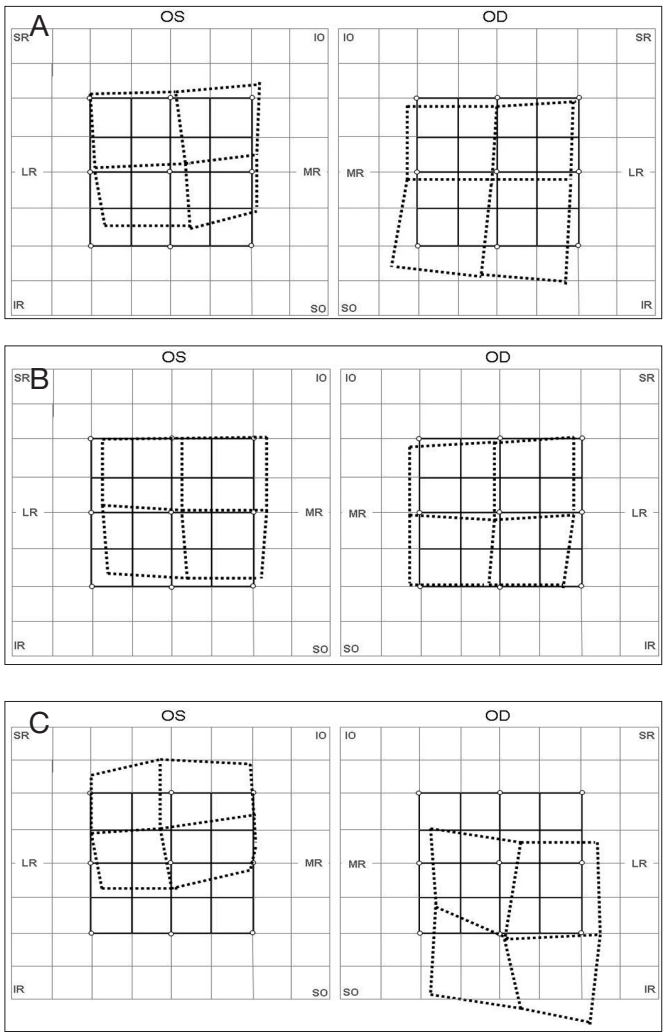

Fig. 1 - *Patient 2. Hess Lancaster screen test in unilateral superior oblique (SO) palsy (left).* **(A)** *Performed in primary: hypertropia of the left eye with SO underaction and slight IO overaction are shown.* **(B)** *Performed with the head tilted to the right: left hypertropia diminished and the test is closer to normality.* **(C)** *Performed with the head tilted to the right: left hypertropia increased, left SO underaction is more noticeable, left SR does not seem to overact, and contralateral IR overacts when the paretic eye is fixing.*

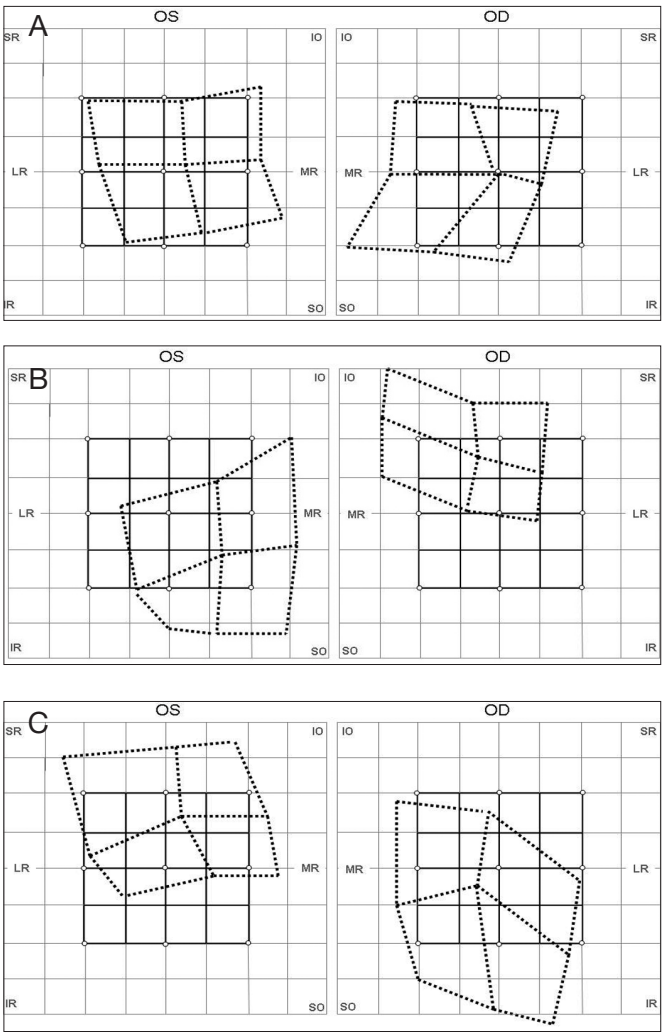

Fig. 2 - *Patient 5. Hess Lancaster screen test in bilateral superior oblique (SO) palsy (left).* **(A)** *Performed in primary: small hypertropia of the left eye with SO underaction and a slight IO overaction are shown. Excyclotorsion in downgaze and esotropia are also noticed.* **(B)** *Performed with the head tilted to the right: vertical deviation reversed and right hypertropia with underaction of right SO and overaction of right IO are noticeable.* **(C)** *Performed with the head tilted to the right: left hypertropia increased, left SO underaction, left IO overaction, and right IR overaction are also noticed.*

significant difference was obtained with a chi square of 4.2 for a critical value of 3.841.

DISCUSSION

Bilateral SO palsies are often challenging cases not only to treat but to diagnose because of the protean forms of presentation. Fourth cranial nerves may be affected asymmetrically and sometimes the involvement of one of the superior obliques could go unnoticed until surgery is performed on the opposite, more affected, side; those have been designated masked cases.

Clinical criteria useful to diagnose bSO palsy have been defined by different authors (2, 4-6, 12): reversal of the hypertropia in any position of gaze, V pattern (difference in horizontal alignment between up and downgaze), bilateral positive head tilt test, and bilateral excyclotorsion. However, no ancillary examination has been proposed to help signifi-

cantly in the diagnosis of bilateral SO palsies.

The HLST is a useful test for diagnosing many motility disorders, particularly oculomotor acquired palsies. Very few studies regarding the usefulness of the HLST in oculomotor palsies are available in the literature (7, 8), but recently, Woo and Hwang (9) studied the usefulness of HLST in patients with SO palsy. They compared the degree of cyclotropia in primary position and in downgaze among patients with SO palsy.

We performed the HLST with the head straight and on head tilt to both sides in order to investigate the eye movements during Bielschowsky head tilt testing.

Countertorsion of the eyes is not completely compensatory for head tilt in humans and it is estimated at 10% to 30% of the size of the head tilt (10). For that reason we did not consider it necessary for all patients to tilt their heads the same amount. A head tilt of between 30 and 45 degrees to perform the test is acceptable for the purpose of this study.

In normal subjects, the HLST performed on head tilt did not show any abnormality regardless of the position of the head. In uSO palsy patients the SO underaction and the ipsilateral IO overaction became more apparent when the head was tilted to the paretic side. In patients with bSO palsy the HLST disclosed a slight vertical deviation when performed in primary, but when it was carried out on head tilt there was a clear reversal of hypertropia; that is, both eyes became alternately hypertropic. Small vertical deviations were measured with prism cover test during Bielschowsky head tilt testing in all patients, but when the HLST on head tilt was performed the deviation seemed to be larger. This enhancement of the vertical deviation achieved with the HLST may be due to the binocular dissociation produced by the red-green filters that prevent any attempt to fuse images.

In order to carry out a successful surgical treatment in strabismus patients, a proper diagnosis must be done. Bilateral SO palsies are not easy to diagnose and more than one surgery is often needed to achieve good results. Although in the present study the number of subjects is small, and further investigation with a higher number of patients might be necessary, we introduce the HLST on head tilt among criteria useful to diagnose bilateral SO palsies.

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Reprint requests to:
Alejandro Armesto, MD
Ophthalmology Department
Hospital de Clínicas
University of Buenos Aires
Juncal 2449-9D
Buenos Aires 1425, Argentina
larmesto@intramed.net

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