Short Communication

Evaluation of Brainstem Dysfunction in Primary Headache Using the Blink Reflex

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Abstract

Analysis of the blink reflex (BR) is a simple noninvasive method to evaluate the nociceptive brainstem pathways which are implicated in the pathogenesis of primary headaches. In the study, 75 patients of primary headaches were evaluated with the BR in the interictal period. There were 51 patients of migraine (Group I), 16 patients of tension-type headache (Group II), 8 patients of cluster headache (Group III), and 70 were control patients (Group IV) at a tertiary care referral center. All were subjected to a thorough clinical examination and were then evaluated with the BR. Significantly prolonged R2i and R2c were found in all study groups as compared to controls. An intergroup comparison with the controls revealed significantly prolonged R2i and R2c in the migraine and TTH group but not in the cluster headache group. Thus, abnormalities in the BR were found even in the headache-free periods in patients with primary headaches, thus implicating persistent sensitization of central brainstem nociceptive pathways. The nonsignificance in cluster headache could be due to small sample size.

Keywords: Blink reflex, brainstem dysfunction, headache, R2i and R2c

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Introduction

Activation of the trigeminovascular system and sensitization of brainstem trigeminal nuclei are thought to play an important role in migraine and possibly, in other chronic primary headaches as well.[1] To study the role of the pontine trigeminal nucleus and its interconnections, some electrophysiological reflexes may be tested; one of these is the blink reflex (BR), described in 1896 by Overend.[1,2] The BR, also known as the orbicularis oculi reflex test, may be indicative of lesions or dysfunctions of the brainstem and particularly assesses the trigeminal-facial arc. This reflex is elicited by stimulation of the supraorbital nerve on one side of the face, leading to two ipsilateral responses (R1 and R2) and one contralateral response (R2c). R1 represents an oligosynaptic pathway involving the main sensory nucleus of the trigeminal nerve and the intermediate subnucleus of the facial nerve. The second response, R2, involves a pathway of descent to the spinal trigeminal tract. The contralateral response, R2c, reflects the crossing of the brainstem in the medulla and progresses through the reticular formation to elicit a response at the contralateral facial nucleus.

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Materials and Methods

The present study was conducted on a cohort of 75 patients of primary headache at a tertiary care referral center. Of the 75 patients of primary headache, there were 51 patients of migraine (Group I), 16 patients of tension-type headache (Group II), 8 patients of cluster headache (Group III), and 70 were control patients (Group IV). They were examined clinically and were subsequently evaluated using the BR using standard guidelines in the headache-free period. All patients were on medication during the evaluation. The BR was carried out on the Medelec Synergy System. Patient was asked to lie relaxed; active recording electrode was placed below the eye just lateral and inferior to the pupil at midposition, with a reference electrode placed just lateral to the lateral canthus. Ground was placed over mid-forehead. Sweep speed was 10 ms/div, sensitivity at 100 μV/div, and filter settings 10 Hz and 10 kHz. For each side, a minimum of 6 stimuli were

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obtained and then superimposed to determine the shortest latencies. Values between 10–12 ms for R1 and 30–40 ms for R2 were taken as normal. The latencies were recorded in all the patients and controls. The latencies in the headache group as a whole was compared with controls, also each headache group was compared with controls.

Statistical analysis was done by computing the mean and standard deviation. The comparison between the control group and the primary headache patients was done using Student's *t*-test and a $P < 0.001$ was considered statistically significant.

Results

R1 response latency on both sides was not significantly prolonged as compared to controls whereas the R2 responses on both sides (R2i and R2c) were significantly prolonged in all headache patients ($P < 0.001$) as compared to controls [Table 1]. Furthermore, an intergroup comparison of all three groups with controls and a comparison of each headache subtype with control also revealed a significantly prolonged R2i and R2c ($P < 0.001$) in Group I and Group II (but not in Group III, cluster headache group), while the R1 latencies were normal in all groups as compared to controls [Table 2].

Discussion

Headache is one of the most common complaints faced both in general medicine and neurological practice. The results of BR studies in primary headache reported in literature have been very heterogeneous. Some authors have identified alterations in these waves in patients with chronic headaches,[3-5] while other authors have failed to replicate these results.[6-11] Furthermore, some authors have only detected alterations in the BR waves during a migraine attack,[6] whereas others have noted alterations during the interattack period in migraineurs.[1,4,5] Several forms of headache have been studied by these authors including episodic migraine,[1,4,5] cluster headache,[6] hypnic headache,[10] tension-type headache,[8-10] and cervicogenic headache.[9] The results have been contradictory, and all studies published so far have only included a few dozen patients and controls, with typically <50 individuals in each group.

A study carried out in 160 patients of chronic migraine did not reveal any abnormalities in the BR.

In our study, we did not find prolongation of the R1 but found prolongation of both R2i and R2c in the headache group as compared to controls. On further subgroup analysis of each headache group with control, prolongation of the R2i and R2c was found in the migraine and TTH group but not in the cluster headache group. All our patients were evaluated during headache-free period and were on prophylactic drugs. This implicates central brainstem involvement with sensitization of the trigeminovascular system which persists even when the patient is free of headache. The insignificant latencies seen in the cluster headache group could be attributed to the small sample size in that group.

Table 1: Comparison of latency between Group 1 (case) and Group 2 (control)

Latency	Group 1 Total (75 cases)	Group 2 Total (70 controls)	*t*	*P*
Rt_R1	11.41893±2.9325045	10.43353±1.7870411	2.396	0.018
RT_R2i	38.91947±3.6350411	36.10912±3.1440366	4.921	<0.001
RT_R2C	42.10587±3.4875660	37.28191±3.1506073	8.647	<0.001
Lt_R1	11.83147±3.0606534	10.39103±1.4385255	3.542	0.001
Lt_R2i	39.04213±4.3886501	36.60235±3.0281915	3.831	<0.001
Lt_R2C	42.35493±3.8264055	37.40559±3.0866817	8.458	<0.001

Data were expressed as mean±SD. Statistical analysis was done by Student's *t*-test and *P*<0.001 was considered significant. Rt: Right, Lt: Left, SD: Standard deviation

Table 2: Intergroup comparison

Latency	Group 1 versus Group 4	Group 2 versus Group 4	Group 3 versus Group 4
Rt_R1	0.071	0.420	0.805
Rt_R2i	<0.001	<0.001	0.954
Rt_R2C	<0.001	<0.001	0.006
Lt_R1	0.075	0.997	0.876
Lt_R2i	<0.001	<0.001	0.474
Lt_R2C	<0.001	<0.001	0.381

Rt: Right, Lt: Left

Conclusion

BR is a simple noninvasive method to indirectly assess the brainstem dysfunction in various primary headaches. Our study revealed prolongation of the R2i and R2c latencies in headache patients. This shows that the trigeminal afferents are altered in headache patients, thus demonstrating a persistent sensitization in the central nociceptive system which were present even during the interictal period.

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Conflicts of interest

There are no conflicts of interest.

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