European Journal of Molecular & Clinical Medicine (EJMCM)
ISSN: 2515-8260 Volume 07, Issue 10, 2020

Original research article

Evaluation of the relationship between Binocular Anomaly and Headache: prospective cross-sectional study

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Abstract

Aim: To evaluate the association of Binocular Anomaly with Headache.

Methods: The prospective cross-sectional study which was carried in the Department of Ophthalmology, Patna Medical College and Hospital, Patna, Bihar, India for 15 months. There were 100 patients with complaints of headache were included in this study. Visual acuity was tested at 6 meters by Snellen's chart and after refraction only the emmetropic patients were included in the study. A slit lamp examination of the anterior segment was done and ocular tension was recorded by applanation tonometer. Fundus fluorescein angiography and OCT for retinal evaluation and Humphrey field charting for glaucoma patients was done if needed.

Results: Majority of patients were young adults in the age group of 20-30yrs (N=48); Females outnumbered males in a ratio of 1.85:1 with 35% males and 65% females. Pain topography showed frontal headache (44%) to be the most common presentation followed by hemicranial type of headache (34%). On orthoptic evaluation, an altered AC/A ratio was found in 73% of individuals complaining of headache, having either low (41%) or high (32%) AC/A ratio ($p < 0.0001$). Out of 100 patients, 40% pts were suffering from convergence insufficiency where as 32% had convergence excess and only 28% had normal convergence range. Direct proportion was seen between Convergence Insufficiency and low AC/A ratio and also between convergence excess and high AC/A ratio (p = 0.000) Accommodation insufficiency was seen in 46% of patients while accommodation excess was present in 36% of patients. Contrary to convergence, accommodation was inversely proportional to AC/ A ratio. Accommodation insufficiency being more common with high AC/A ratio (67.39%)whereas accommodation excess was seen more in patients having low AC/A ratio (83.33%) p=0.0001. Fusional vergence findings showed normal vergence in only 20(20%) patients. Reduced negative fusional vergence was seen in 38% patients and was more commonly associated with high AC/A ratio (39%), while reduced positive fusional vergence was present in 42% patients and was more common with low AC/A ratio 36 (85.71%).

Conclusion: Headache was more common in females and was associated with exophoria, convergence insufficiency and inadequate positive fusional vergence at near fixation.

Keywords: Headache, binocular vision, exophoria, convergence insufficiency.

Introduction

Headache is one of the commonest health complaints and it affect approximately half of world population. It has significant effect on work productivity and quality of life.[1] The problem may arise from conditions that range from benign to catastrophic. Quick and accurate diagnosis is an important step for successful management of headache.[2,3] A review of studies conducted globally, estimated the prevalence of headache as 58.4% among school-

going children and 46% in adult population.[2,3,4] It is commonly believed that refractive errors and binocular vision anomalies can lead to headache among young individual.4 Eye care professional reported that headache is a common patient complaint.[5,6,7] International headache society reported that the diagnostic criteria of headache associated with refractive errors is as follows: a) Uncorrected refractive errors such as hypermetropia, astigmatism, presbyopia, or wearing incorrect glasses, b) Mild headaches in the frontal region and in the eyes, c) pain absent on awakening and worse by prolonged visual tasks at distance or near.[8] In a masked case control study, to assess the relation between headache and binocular vision anomalies it was concluded that people suffering from headache had higher prevalence of heterophoria, associated phoria and reduced stereopsis compared with controls. The study found that there was strong association between exophoria and complaint of headache.[9] Another study has indicated that the positive fusional reserve should be at least twice the magnitude of an exophoria to be compensated (without symptoms).[10] Binocular visual dysfunctions such as convergence insufficiency (CI) affects young people and is characterised by the inability to accurately converge, or sustain accurate convergence when focusing at near targets. It is associated with symptoms such as headache, blurry vision, eyestrain, and double vision.10 Headache may also be due to different ocular diseases such as acute glaucoma, optic neuritis, uveitis, and visual anomalies such as uncorrected refractive errors, accommodative and vergence dysfunctions. The most common eye condition leading to headache after refractive errors is binocular vision anomalies.[11] There is a general increase in the number of people suffering from headaches. In addition, headaches have a significant negative impact on the quality of life and productivity. Therefore, the current study was conducted to assess the clinical characteristics of patients suffering from headaches who attended the binocular vision at department of Ophthalmology, Patna Medical College and Hospital, Patna, Bihar, India.

Material and methods

The prospective cross-sectional study which was carried in the Department of Ophthalmology, Patna Medical College and Hospital, Patna,Bihar India for 15 months, after taking the approval of the protocol review committee and institutional ethics committee.

Inclusion criteria

There were 100 patients with complaints of headache who either had come by their own or were referred from other departments to the department of Ophthalmology. Patients were also referred to other departments to rule out non-ocular cause of headache.

Exclusion criteria

Patients who had non-ocular headache and other causes of ocular headache (hysteria, malingering, neurogenic causes such as intracranial space occupying lesion, benign intracranial hypertension, meningitis, giant cell arteritis; sinusitis, otitis, vascular headaches such as migraine; angle closure glaucoma, uveitis, optic neuropathy, etc; patients on NSAIDs/anticholinergic drugs – psychiatric medicines, cold, dysmenorrhoea etc; or patients using video display terminals for greater than 2 hr/day at a stretch) were excluded from the study.

Methodology

Selected patients were interviewed according to a pre-designed and pre-tested performa. Detailed history of headache pattern, life style pattern and eating habits was taken. Ocular evaluation consisted of detailed refractive check-up, binocular vision assessment and anterior segment and posterior segment examination.

Visual acuity was tested at 6 meters by Snellen's chart and after refraction only the emmetropic patients were included in the study.
A slit lamp examination of the anterior segment was done and ocular tension was recorded by applanation tonometer. Fundus flourescein angiography and OCT for retinal evaluation and Humphrey field charting for glaucoma patients was done if needed.
Detailed orthoptic examination was done and the diagnosis was made as defined below. Convergence insufficiency: (1) Near point of convergence.[12] (NPC)> 6 cm and; (2) Positive fusional convergence.[13,14] (PFC) <15 PD. Accommodative insufficiency[11] (Cacho criteria): Near point of accommodation (NPA) <15-0.25 x Age.
The most common method of determining the AC/A ratio is the gradient method in which the phoria at near is measured after changing the accommodation with a spherical lens (usually +1.00 Dor -1.00D) placed in front of the two eyes. It is expressed as
AC/A = (α –α')/ F where α = near phoria and α' is distance phoria: F is power of lens used. (exodeviation is taken as positive and exodeviation as negative).

Statistical analysis
Data entry and statistical analysis was done using Statistical Package for Social Sciences (SPSS software version 20) and inferences drawn. Mantel-Haenszel chi-square test (χ2MH) was used to control any possible confounding variable, wherever necessary. A 'P' value of less than 0.05 was taken as significant.

Results
Total of 100 emmetropic individuals having headache with no other systemic problem were included in the study.
Majority of patients were young adults in the age group of 20-30yrs (N=48); Females outnumbered males in a ratio of 1.85:1 with 35% males and 65% females. (Table 1)
Pain topography showed frontal headache (44%) to be the most common presentation followed by hemicranial type of headache (34%). (Table 2)
On orthoptic evaluation, an altered AC/A ratio was found in 73% of individuals complaining of headache, having either low (41%) or high (32%) AC/A ratio ($p < 0.0001$). Out of 100 patients, 40% pts were suffering from convergence insufficiency where as 32% had convergence excess and only 28% had normal convergence range. Direct proportion was seen between Convergence Insufficiency and low AC/A ratio and also between convergence excess and high AC/A ratio ($p = 0.000$) (Table 3).
Accommodation insufficiency was seen in 46% of patients while accommodation excess was present in 36% of patients. Contrary to convergence, accommodation was inversely proportional to AC/ A ratio. Accomodation insufficiency being more common with high AC/A ratio (67.39%)whereas accommodation excess was seen more in patients having low AC/A ratio (83.33%) p=0.0001. (Table 4).
Fusional vergence findings showed normal vergence in only 20(20%) patients. Reduced negative fusional vergence was seen in 38% patients and was more commonly associated with high AC/A ratio (39%), while reduced positive fusional vergence was present in 42% patients and was more common with low AC/A ratio 36 (85.71%). (p=0.0279) (Table 5).
On correlating the type of headache with AC/A ratio we observed that throbbing type of pain was associated more with low AC/A ratio while piercing type of headache was seen with high AC/A ratio ($p = 0.612$) (Table 6).

Table 1: Headache related with age and sex

	Gender		
Age Group	Male	Female	Total
10-20 Yrs	13 (38.24%)	21 (61.76%)	34
20-30 Yrs	17 (35.42%)	31 (64.58%)	48
30-40 Yrs	3(27.27%)	8 (72.73%)	11
40-50 Yrs	2(40%)	3 (60%)	5
50-60 Yrs	0 (0.00%)	2(100%)	2
TOTAL	35 (35%)	65(65%)	100

Table 2: Distribution of patients according to pain topography in relation to working hours

Working hours	**Occipital**	**Frontal**	**Hemicranial**	**Generalised**	**Total**
Upto 4hrs	2 (5%)	21 (52.5%)	13 (32.5%)	4 (10%)	40
5-8hrs	-	13(46.43%)	9 (32.14%)	6 (21.43%)	28
9-12hrs	-	5 (62.5%)	2 (25%)	1 (12.5%)	8
13-16hrs	2 (8.33%)	5 (20.83%)	10 (41.67%)	7 (29.17%)	24
Total	4 (4%)	44 (44%)	34 (34%)	18 (18%)	100

Table 3: AC/A ratio as related with convergence

	Convergence	**High**	**Low**	**Normal**	**Total**
AC/A ratio	Insufficiency	1 (2.5%)	36 (90%)	3 (7.5%)	40
	Excess	28 (87.5%)	2 (6.25%)	2 (6.25%)	32
	Normal	3 (10.71%)	3 10.71%)	22 (78.58%)	28
	Total	32(32%)	41(41%)	27(27%)	100

Table 4: Accommodation as related with AC/A ratio

	Accommodation	**High**	**Low**	**Normal**	**Total**
AC/A ratio	Insufficiency	31 (67.39%)	4(8.69%)	11 (23.91%)	46
	Excess	2 (5.56%)	30 (83.33%)	4 (11.11%)	36
	Normal	3 (16.67%)	5 (27.78%)	10 (55.56%)	18
	Total	36 (36%)	39 (39%)	25 (25%)	100

Table 5: Fusional vergence as related with AC/A ratio

Fusional vergence	**AC/A ratio**			
	High	**Low**	**Normal**	**Total**
Reduced Negative	33 (39%)	2 (3.10%)	3 (7.50%)	38
Reduced Positive	2 (4.76%)	36 (85.71%)	4 (9.52%)	42
Normal	3 (15%)	4 (20%)	13 (65%)	20
Total	38 (38%)	42 (42%)	20 (20%)	100

Table 6: Type of headache as related with AC/A ratio

Type of Headache	**AC/A ratio**			
	High	**Low**	**Normal**	**Total**
Throbbing	22 (31.43%)	30 (42.86%)	18 (25.71%)	70
Piercing	7 (46.67%)	6 (40%)	2 (13.33%)	15
Dull Aching	3(37.5%)	4 (50%)	1 (12.5%)	8
Gnawing	2 (28.57%)	3 (42.86%)	2 (28.57%)	7
Total	34 (34%)	43 (43%)	23 (23%)	100

Discussion

Headache is experienced by majority of population and has a major impact on public health. The condition has been ranked among the ten most disabling conditions by the world health organisation. Headache is common during childhood and it becomes even more common and more frequent during adolescence.

In our study, the commonest binocular anomaly was accommodation insufficiency was seen in 46% of patients while accommodation excess was present in 36% of patients, while according to Mocii F et al.[15] convergence insufficiency is the most frequent cause of muscular aesthenopia. This prevalence of convergence insufficiency is less than that of Gupta et a[16] (49%), Romania[17] (60.4%) and Patwardhan and Sharma[18] (71.4%), while it is more than that of Sanjay et al[19] (16.25%). These discrepancies might be because of the different working environment of the patients.

In our study, accomodative insufficiency is associated with low AC/A ratio, which is normally overcome by positive fusional reserve but when this fusional reserve is also insufficient the patient develops the symptom of asthenopia and then actual headache. This fusional reserve become insufficient due to functional causes such as overwork or deficient physiology though there may be other non-functional causes. And this may be the reason for headache in younger age group as they stress their eyes by staying awake at night and watching television or computers and also skipping meals.

In this study, headache was more common in females ($p>0.001$) similar to the observations of Hendricks et al[20] and sanjay et al[19] , with females having more than two fold prevalence over males especially in young adults in the age group of 20-30 years. Headache prevalence in this particular age group might be because of the psychological stress caused by educational pressures for career development and emotional factors. Female preponderance could be because of the culturally set factors and the effects of male dominated society which may lead to psychological stress.[21] In our study, patients in the school age comprised of 34%. Headache in this age group could be because of peer pressure for better performance in the studies and extracurricular activities.

Regarding the site of headache, our study revealed that the frontal (44%) followed by unilateral location (34%) were the commonest sites. According to Unp et al (2005)[22] most of the patients who suffered from headache defined more than one location. More than half of the studied sample (70%) had throbbing type of headache followed by piercing type in 15%. Throbbing headache was commonly associated with low AC/A ratio (42.86%) while piercing type was commonly associated with high AC/A ratio (46.67%). These findings were similar to the studies of Unp et al. 2005[22] and Ayatollahi & khosravi (2006).[23]

Various studies have stated different precipitating factors for headache such as skipping meals, and inadequate or irregular sleep, and stress to be majorly responsible for headache. Isik et al (2006)[24] and El tallawy et al (2006)[25] reported them to be the most common precipitating factors for headache in 69%, 83.6% and 72.6% cases respectively. Hunger or missed meal is shown to be a precipitating factor in 60.06% of children by Blau et al (2004).[26]

Other precipitating factors were staying for long in front of TV or computer, ingestion of cold drink or ice cream and eating chocolate or cheese in a study carried out by Stovner *et al* (2007).[27] These environmental triggers, light, sound and smell are transmitted directly to the central nervous system (CNS) by the special senses and thus cause direct excitation of the neural pathways which then causes headache attack. We could not include them in our study due to limited resources.

Conclusion

The present study conclude that headache was more common in females and was associated with exophoria, convergence insufficiency and inadequate positive fusional vergence at near fixation.

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Received: 18-08-2020. Revised: 04-09-2020. Accepted: 24-09-2020