The relationship between anemia and accommodative esotropia in children

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Background: Refraction problems, motor disorders, sensorial disorders, physical and psychic traumas of eye may be responsible for development of strabismus. Anemia may cause sensory-neural disorders in children. We investigated the relationship between anemia and accommodative esotropia in children. **Materials and Methods:** Sixty-four patients with accommodative esotropia were evaluated. This group was identified as patient group (group 1). Eighty-three pediatric patients, who were not esotropia and only had refraction problems, were identified as control group (group 2). The difference between the groups was statistically analyzed evaluating patients for anemia. **Results:** 33 of 64 patients with accommodative esotropia in group 1 were male, as 43 of 83 patients with refractive error in group 2 were male. The mean age of patients in group 1 and 2 were 6 ± 3.92 and 6.37 ± 2.74 ($P > 0.05$) respectively. There was significant difference between two groups, when mean hemoglobin value of those was compared ($P < 0.05$). **Conclusion:** Hb level may affects the accommodative esotropia.

Key words: Anemia, child, esotropia, strabismus

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INTRODUCTION

Accommodative or refractive esotropia is a strabismus that emerges as a result of focusing efforts of eyes for clear view. These patients are often hypermetropia. This situation means that eye muscles have to work harder to view close objects.[1] This focusing effort is called as accommodation. Accommodation will activate accommodative convergence. If fusional divergence is not sufficient for a person, esotropia may emerge as a side effect of extreme accommodation effort to see close objects clearly.

As occurrence form of strabismus and discussions about its reasons has still been proceeding. Refraction problems, sensory disorders, motor disorders (muscle adhesion anomalies of over and peripheral nerve disorders), fusion failure mechanism, innervational or mechanical factors such as physical or psychic trauma are thought to be effective over the emergence of strabismus.[2]

Binocular vision does not exist with strabismic amblyopia, if the shift is monocular in the strabismus <5 years old. Even if amblyopia does not occur in alternating strabismus, fusion mechanisms does not work, and stereosis (depth perception) does not develop. Even if it is developed, this incurs loses. This developmental disorder becomes permanent, and the sense of depth slim never develops then. This is why early treatment is very important to provide vision rehabilitation and binocular vision again. The strabismus should be pathologically evaluated and examined by an eye physician, except the first 3 months of life.

Anemia is defined as having low mean value less than two standard deviation (SD) of hemoglobin (Hb), hematocrit (Hct) or red blood cell values according to age and gender in humans[3-5] although, decrease in Hb is often with the decrease in the number of red blood cells, the number of red blood cells may sometimes remain normal despite the decreased Hb levels, as well as in iron deficiency anemia (IDA).[6]

The most common cause of anemia is IDA. Growth and mental development in children with iron deficiency are corrupted whether there is an accompanied anemia. In some studies, although cognitive development was improved by Fe addition, cognitive disorder was found as irreversible in other studies despite the improved Fe status.[7,8] Although, the reason of deterioration of

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nervous system functions with iron deficiency has not been known yet, needing iron of some enzymes in the brain to function normally is thought to play role in this regard. We have aimed to investigate the relationship between anemia and accommodative esotropia in children.

MATERIALS AND METHODS

A group of 64 patients with accommodative esotropia was selected from child patients, who applied for eye clinic of our hospital (group 1). Eighty-three pediatric patients who only had refraction problem and was not esotropia were included in the study as the control group (group 2). All patient files were retrospectively analyzed. Patients with any systemic disease except anemia were excluded. We have compared these groups in terms of Hb, Hct, mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC) and mean ferritin value. Anemia was defined as Hb is below 11 g/dl.[9] Results were statistically evaluated using the SPSS v. 15.0 program. *T*-test for independent samples and Pearson correlation analyzes are used in statistical evaluation of the data.

RESULTS

A total of 147 patients were included in the study. Thirty-three of 64 patients with accommodative esotropia in group 1 were male, as 43 of 83 patients with refractive error in group 2 were male. The mean age of patients in group one is 6 ± 3.92. The mean age value of patients in group 2 is 6.37 ± 2.74 ($P > 0.05$).The mean Hb value of patients in group 1 is 12.05 ± 0.98 g/dl (normal range: 11-14 g/dl). The mean Hb value of patients in group 2 is 12.91 ± 1.46 g/dl. There was significant difference between two groups, when mean Hb value of those was compared ($P < 0.05$). The mean Hct value of group 1 was 36.04 ± 2.70%, as the mean Hct value of group 2 was 37.90 ± 4.01%. There was significant difference between case and control group in terms of mean Hct value ($P < 0.05$) [Table 1]. Our study, 11 patients (17.2%) in group 1 and group 2, eight patients (%9.6) had anemia.

Table 1: The relationship between anemia and esotropia

Characteristics	Accomodative (group 1)		Only refractive error (group 2)		*P*
	N	Mean±SD	*n*	Mean±SD	
Age (years)	64	6±3.92	83	7.75±4.01	0.921
Hb (mg/dl)	64	12.05±0.98	83	12.91±1.46	0.008
Hct (%)	63	36.04±2.70	83	37.90±4.01	0.011
MCH (pg)	62	26.08±1.90	83	27.11±2.24	0.962
MCHC (g/dl)	62	33.59±1.49	83	34.00±1.61	0.623
MCV (fL)	62	78.08±4.52	83	78.27±10.15	0.059
Ferritin (ng/ml)	16	30.97±11.67	38	29.66±24.83	0.184

Hb=Hemoglobin; Hct=Hematocrit; MCV=Mean corpuscular volume; MCH=Mean corpuscular hemoglobin; MCHC=Mean corpuscular hemoglobin concentration; SD=Standard deviation

Mean MCH value of group 1 was 26.08 ± 1.90 pg. Mean MCH value of group 2 was 27.11 ± 2.24 pg. Mean value of MCHC in group 1 was 33.59 ± 1.49 g/dl. In group 2, mean MCHC value of was 34.00 ± 1.61 g/dl. Mean MCV value in group 1 was 78.08 ± 4.52, as it was 78.27 ± 10.15 in group 2. The mean ferritin value of group 1 was 30.97 ± 11.67. It was 29.66 ± 24.83 in group 2. The difference was not significant for MCH, MCHC, MCV and ferritin, when we compared these two groups [Table 1].

DISCUSSION

The eye, settled into the orbital, is a sensorial body that is outward extension of the forebrain.[1] The majority of strabismus is represented as comittant esodeviation. Esodeviation is latent or manifest shifting of visual axis. Latent shifting is called as esophoria, as manifest shift is called esotropia.[10] Convergence and divergence mechanisms are active according to Duane. The cause of esotropia is innervational imbalance between these mechanisms.[11]

Refractive accommodative esotropia is a physiological response which developed against excess hyperopia, falling beyond the fusion divergence amplitude of patients. Convergence mechanism is more efficient due to insufficient fusion divergence, and the increasing esotropia occurs in particular. It is referred as exact refractive accommodative esotropia. A typical story is usually the attracted attention of intermittent esotropia, when it is around 3 years old, tired, dreamy, emerged at the end of the day and especially in close proximity. The shifting may be suddenly begun in some patients after the passed fever history, a fall or stress. In these patients, there is a certain amount of uncorrected hyperopia. Patients attempt to compensate for their uncorrected hypermetropia with accommodation and clarify the blurred dream of retina. Refraction problems, sensory disorders, innervational and mechanical problems such as physical and psychic trauma are thought to cause strabismus.[2]

Anemia is a condition in which mean Hct value, Hb or red blood cells was 2 SD less than normal according to age and gender in humans.[3,4] It is recognized as an important health problem in childhood, because it has negative effects over the mental and physical development. Twelve percent of children <5 years ago in the developed countries and 51% of children in the same age group in developing countries are anemic.[12]

Anemia is a disease, which affects many hematologic and non-hematologic systems. It has effects on biochemical changes of cellular functions, growth, psychomotor development, behavior, mental development, immune

system, physical capacity, gastrointestinal system and thermo regulation.[13]

In conclusion, we have seen that Hb and Hct values were statistically lower in the group of patients with accommodative esotropia than in control group. We could not find any significant difference, when we evaluated for MCH, MCHC, MCV, and Ferritin results. The result of this study suggest that Hb level may affect the accommodative esotropia. The most common cause of anemia is IDA all over the world.[14] The relationship between the IDA and mental retardation has been proven with recent trials in early period of life.[15] Result of the study has demonstrated that accommodative esotropia may be caused by anemia, which is known to affect neurosensorial development. However, the most frequently encountered etiologic factor in developing of anemia is nutritional inadequacy. Therefore, there may be situations which affect neurosensorial development within situations that may arise as a result of malnutrition except anemia. The studies, eliminating these factors, are needed to perform. Any similar study was not encountered in the literature. For this reason, we think our study will contribute to the literature.

LIMITATION OF THE STUDY

The most important limitation being lesser number of cases, although, our study has yielded some preliminary findings its design is not without flaws. This study will shed light on new studies.

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