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CLINICAL STUDY

Amblyopia and sensory features at initial presentation of Brown syndrome: an issue to recognize

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Abstract

Purpose **To investigate the frequency of amblyopia and sensory features at initial presentation in patients who had unilateral congenital Brown syndrome (BS) and to identify the potential risk factors for amblyopia in BS.**

Methods **The study conducted with patients who had unilateral congenital BS. Patient demographics, visual acuity, refractive errors, amount of horizontal and vertical deviations, abnormal head position, fusion, and stereopsis were all reviewed. The main outcome measure was the frequency of amblyopia at initial presentation.**

Results **The review identified 44 patients with BS (median age 5 years). The frequency of amblyopia was 15.9% (seven patients) in BS at initial presentation. Patient age ($P=0.297$), ocular alignment at primary position ($P=0.693$), anisometropia ($P=0.184$), and stereoacuity ($P=0.061$) were found to have no significant relation with amblyopia. The main associated risk factor was the absence of sensory fusion ($P=0.013$).**

Conclusions **Amblyopia may be encountered among patients with BS, and may be related to binocularity of the patient. Its recognition may be a critical step during the treatment planning and may determine presumably the success of future therapies.**

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Introduction

Brown syndrome (BS), which was first described by Brown in 1905, is characterized with limitation of elevation in adduction, normal or near normal elevation in abduction, positive forced duction test with compensatory head posture.[1,2] The clinical features underlying complex anatomical relations have been described in the literature.[1]

The objective of the study was to define the frequency of amblyopia and sensory features in patients with BS at initial presentation and to identify the risk factors that may be associated with amblyopia.

Subjects and methods

The study was conducted in Hacettepe University School of Medicine Department of Ophthalmology, Pediatric Ophthalmology and Strabismus Unit. The study was carried out in full accord with the principles laid out in the Declaration of Helsinki and the approval of the institutional review board was obtained. Patients diagnosed as having BS at initial examination were enrolled in the study for the following inclusion criteria: diagnosis made by a pediatric ophthalmologist and absence of previous ocular surgery.

The indications for surgery, the type of strabismus operations, and postoperative clinical features were beyond the purposes of this study. The main purpose of the study was to investigate the frequency of amblyopia with potential risk factors and the sensory features at initial presentation.

The data included gender and age of the patients, best-corrected visual acuity, presence of amblyopia, type of manifest deviation at primary position, the amount of horizontal near and distance deviations, vertical deviations, presence of abnormal head position, refractive errors, fusion, and stereopsis. The medical files of the patients were reviewed.

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Visual acuity was evaluated by using LEA chart or Snellen chart if possible. Ocular alignment was assessed by using prism cover test and it was performed at 33 cm and 6 m in order to measure near and distance deviations (Δ). Krimsky test was carried out in cases of uncooperative patients.

The presence of abnormal head position was noted.

Presence of stereopsis was evaluated by Titmus testing and sensory fusion was assessed by Worth-4-Dot testing. Fusion was recorded as being present if the patient saw four dots on Worth screen.

Amblyopia was defined as a difference of two or more lines between the best-corrected visual acuity of both eyes recorded using a visual acuity chart. Anisometropia was identified when a refractive difference of 1.50 D or more (either sphere or cylinder) existed between the two eyes.

Statistical analyses were performed using SPSS software for Windows version 15.0 (Statistical Package for the Social Sciences, SPSS, Inc., Chicago, IL, USA). For abnormal distribution of quantitative data, Mann–Whitney *U*-test was used to compare two independent groups. Comparison between groups was performed using χ^2 test with Yates' correction and likelihood ratio test for categorical variables. The kappa coefficient was used to examine the level of agreement between the two assessments. Median and range were given as descriptive statistics for quantitative data. Categorical data were summarized using frequency and percentages. Result was accepted as statistically significant when P was <0.05.

Results

The medical record review identified 44 patients who had unilateral congenital BS. Of the 44 patients, 18 (40.9%) were men and 26 (59.1%) were women. None of the patients had associated structural ocular or systemic abnormalities.

The median age of patients with BS was 5 years (4–21). Of the 44 patients with BS, 19 (43.2%) had right and 25 (56.8%) had left BS.

Of the 44 patients, 7 (15.9%) had amblyopia. The median best-corrected visual acuity was 6/10 (6/60–6/6) for all patients. The median visual acuity of the amblyopic eye was 6/60 (6/126–6/12). The amblyopic eye was the right eye in four (57.1%) patients and left eye in three (42.9%) patients.

Thirteen patients (29.5%) were using spectacles at initial presentation. In all, 24 patients (54.5%) had hyperopia, 19 patients (45.7%) had astigmatism, and 5 patients (11.4%) had myopia. Fourteen patients (31.8%) had anisometropia among whom four patients (28.6%) had amblyopia. Six of the 14 patients who had anisometropia were wearing glasses.

At initial presentation, 23 (52.3%) patients had no deviation at primary position. Six patients (13.6%) had esotropia, eight patients (18.2%) had exotropia, and seven patients (15.9%) had vertical deviations. Four patients (4/21, 19.0%) with constant squint had amblyopia. One patient who had constant squint without binocularity had amblyopia.

The median horizontal near deviation was 25 Δ (4–55). The median horizontal distance deviation was 20 Δ (4–50). The median vertical deviation was 20 Δ (6–30). The abnormal head position was present in 22 (50.0%) patients.

There was no significant relation between presence of amblyopia and patient age ($P=0.297$), ocular alignment in primary position ($P=0.693$), anisometropia ($P=0.184$), stereoacuity ($P=0.061$), hypermetropia ($P=0.428$), myopia ($P=0.173$), and astigmatism ($P=1.000$). However, amblyopia was significantly related to absence of sensory fusion ($P=0.013$). Furthermore, the presence of hypermetropia was not a risk factor for loss of binocularity ($P=1.000$ for fusion and $P=0.363$ for stereopsis).

The agreement of the involved eye with amblyopic eye was evaluated by using kappa analysis. The agreement was insignificant ($P=0.147$) and kappa coefficient was found to be 0.46, which meant that the affected eye was not in concordance with the amblyopic eye.

Six of 18 patients (33.3%) who had no sensory fusion, had amblyopia whereas 3 of 20 patients (15.0%) without stereopsis, had amblyopia. Among amblyopic patients, one had anisometropia without binocular function and one had binocular function without anisometropia.

Conclusion

BS is a form of restrictive strabismus, which is mainly caused by abnormalities arising from superior oblique muscle-related and -unrelated reasons including orbital masses and pulley abnormalities.[1,3] The specific clinical characteristics, surgical techniques, and their outcomes are also well defined.[1,2,4]

In this study, we investigated its contribution and risk factors in patients with BS at initial presentation in regard of the idea of amblyopia as a potential contributor for all types of strabismus.

Main amblyogenic risk factors were defined to be as anisometropia of >1.5 D, manifest strabismus, hyperopia of >3.5 D, any media opacity of >1 mm in size, astigmatism of >1.5 D at 90° or 180° and >1.0 D in oblique axis, and ptosis by AAPOS Vision Screening Committee previously.[5] Weakley[6] found that myopic anisometropia of >2 D and hypermetropic anisometropia of >1 D brings the increased incidence

and severity of amblyopia, furthermore cylindrical anisometropia of >1.5 D may cause the alteration of binocular function. In this study, anisometropia and strabismus were not found to be significant amblyogenic factors.

Some of the clinical characteristics of the patients with BS are similar to previous studies.[1,4] In this study, there were 18 (40.9%) men and 26 (59.1%) women and 19/44 were right eyes whereas in the study of the 38 congenital Brown cases of Wright,[1] 18 were men (47.4%) and 20 were women (52.6%) and 22/36 (for unilateral Brown syndrome) were right eyes. However, in this study, the amblyopia was more common compared with its frequency in Wright's study 7/44 (15.9%) *vs* 2/38 (0.05%)). Furthermore, 26/38 (68.4%) patients had measurable stereopsis, which was also higher compared with the number of this study (24 patients, 54.5%). The diversity of patient characteristics may be a potential source of these different statistics.

Tredici and von Noordeen[7] investigated the prevalence of amblyopia and anisometropia among patients with Duane syndrome. They found the prevalence of amblyopia as 3%, whereas anisometropia was present in 17% of patients. In this study, the frequencies were 15.9% for amblyopia (7 patients) and 31.8% for anisometropia (14 patients).

Patients with BS use abnormal head posture in order to maintain and enhance their binocular single vision. However, intermittent deviations during visual development may reduce their stereoacuity as mentioned by Sloper and Collins for Duane syndrome.[8] This finding was also supported by electrophysiological evidence of reduced cortical binocular interaction.[9] Furthermore, torsional disparity may contribute to the alteration of binocular single vision when it exceeds the cyclofusion limits.[10] The torsion was not evaluated and measured in this study but these findings may be also likely to be of relevance to the development of amblyopia and defect in binocularity in BS. Furthermore, the binocular status of the patients may be affected in regard of the presence and also the depth of amblyopia as well.[11]

The presence of ocular misalignment in primary position and amount of deviations may be potential risk factors for amblyopia, however, none of these factors were found to be significantly related in this study. There was a significant relation between fusion and amblyopia whereas stereoacuity and amblyopia were almost significantly related ($P=0.061$).

The results of the study should be evaluated within the context of its limitations. This study had retrospective nature and reflects the results of a single reference center. The latter may be a potential source of selection bias. Patients who had ocular misalignment or decreased visual acuity may have been referred from peripheral hospitals. The results of this study may not be representative for all patients with BS. The absence of surgical results may also draw the attention. However, the indications and the type of surgery were not among the main outcomes of this study, and finally forced ductions were not performed on any patients, and so the restriction of ocular movements were not graded. The mentioned results may cause over or under estimation of the frequency of amblyopia among patients with BS. It is also possible that a smaller sample size or the referral pattern of the study population could account for the difference of frequencies of some clinical features including frequency of amblyopia and manifest deviations. The lack of electrophysiological studies about cortical binocular activity may also be considered as another limitation of the study.

We report here the amblyopia frequency in patients with BS at initial presentation in this study. The results of the study indicate that amblyopia seems to present at the initial examination of these patients regardless of clinical features. The results also suggest that the frequency of amblyopia and lack of binocularity among patients with BS is substantial and surgeons may approach these cases with great caution in view of accurate refraction and amblyopia treatment and should take level of binocularity into consideration. Amblyopia should be appraised and treated adequately on approval of the patient.

In conclusion, complete ocular examination, especially assessment of visual acuity and binocularity are mandatory for this patients not only for the determination of amblyopia but also for the success of the probable future surgery.

Summary

What was known before

- Amblyopia is a potential contributing factor for all types of strabismus.

What this study adds

- Amblyopia associated with altered binocular function may be an accompanying clinical feature among patients with BS.

Conflict of interest

The authors declare no conflict of interest.

Acknowledgements

The study was conducted in the Department of Ophthalmology, Hacettepe University School of Medicine, Ankara, Turkey.

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