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Original Article

The Impact of Congenital Strabismus Surgery on Quality of Life in Children

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Abstract

Purpose: To assess quality of life (QOL) in children undergoing strabismus surgery.

Methods: This prospective cohort study included 87 children (including 41 boys, 47.1%) with mean age of 8.7 ± 4.1 years at three academic eye hospitals in Tehran. A modified version of the RAND Health Insurance Study QOL questionnaire was filled based on interviews with parents before and three months after surgery. The questionnaire consisted of 36 Likert scale items ranging in score from 0 to 100, with higher scores representing better function. Relevant items were averaged together and categorized into 11 distinct QOL dimensions.

Results: The majority of QOL dimensions improved after strabismus surgery including functional limitation (92.36 ± 16.78 vs. 82.15 ± 20.92 , $P < 0.01$), anxiety (68.61 ± 18.15 vs. 60.28 ± 19.19 , $P < 0.01$), depression (82.31 ± 16.42 vs. 72.36 ± 17.72 , $P < 0.01$), positive well-being (73.33 ± 14.69 vs. 70.56 ± 15.96 , $P = 0.048$), social relations (79.43 ± 11.52 vs. 68.69 ± 30.98 , $P = 0.002$), general health perception (76.4 ± 16.48 vs. 67.36 ± 18.9 , $P < 0.01$), resistance/susceptibility (79.72 ± 13.4 vs. 71.02 ± 14.58 , $P < 0.01$), satisfaction with development (73.81 ± 16.07 vs. 70.07 ± 14.98 , $P = 0.006$), and eye alignment concerns (75.44 ± 15.89 vs. 53.14 ± 26.61 , $P < 0.01$). Only self-reported prior health (71.73 ± 15.9 vs. 72.78 ± 15.29 , $P = 0.33$) and parent-child closeness (72.92 ± 15.82 vs. 72.5 ± 17.99 , $P = 0.73$) did not significantly improve. The amount of ocular realignment (more vs. less than 20 prism diopters [PD]) had a direct correlation with improvement in subscales of satisfaction with development (0.019) and eye alignment concerns (0.028).

Conclusion: Strabismus surgery positively impacts physical and psychosocial function in children. Children with a greater amount of correction experienced more QOL improvement after surgery.

Keywords: Quality of Life; Strabismus; Surgery

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INTRODUCTION

Strabismus as an ophthalmologic problem that negatively affects quality of life (QOL) through visual dysfunction and abnormal appearance.^[1,2] Strabismus is associated with specific and non-specific negative feelings including lack of self-esteem and self-confidence, general disability,

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and problems in social and physical functions.^[2-4] In adults, it can affect self-image, job difficulties, social interaction and daily tasks.^[5]

In comparison to adults, measuring the negatives psychosocial impact of strabismus in children is more complicated because vision-specific QOL questionnaires have not been broadly developed for this age group and it is difficult to apply the same methodology used for adults to children.^[1,6] Nevertheless, by using a general health-related QOL instrument, Wen et al showed strabismus significantly worsens different aspects of QOL including physical, psychosocial, emotional and school functioning in young children and this negative impact exists even after adjusting for gender, age, ethnicity and family income levels.^[7]

In addition, there is a negative attitude toward strabismus among peers and care givers that may affect the way they interact with the affected children.^[8,9] It suggests that although the primary objective of strabismus surgery is to realign the eyes to restore or improve binocular vision, establish normal eye alignment may offer both children and adults improvement in psychosocial functioning.^[4]

The present study was designed to assess QOL in children undergoing congenital strabismus surgery and to compare it with preoperative physical and psychosocial function.

METHODS

This multicenter prospective cohort study was performed at the three referral academic hospitals in Tehran, namely Labbafinejad Medical Center, Imam Hossein Hospital and Farabi Eye Hospital, in 2012. The study was approved by the Ethics Committee of the Ophthalmic Research Center, Shahid Beheshti University of Medical Sciences, Tehran, Iran. Written informed consent was obtained from the parents or legal guardians.

Children aged 5 to 15 years with congenital strabismus who were scheduled for strabismus surgery by pediatric ophthalmologists were enrolled in the study. Subjects were excluded if they had strabismus surgery within the last year, were dealing with family issues (e.g., parental divorce, separation and single parent families), or had known psychological or chronic ophthalmologic/systemic disorders which might interfere with outcomes of surgery outcome or psychosocial behavior.

All participants underwent a comprehensive eye examination including assessment of preoperative visual acuity, and pre- and postoperative ocular alignment. The RAND Health Insurance Study questionnaire was applied for evaluating QOL.^[10] In addition, some items related to eye alignment concerns introduced by Archer et al were added to our data collection tool.^[1] The questionnaire was translated into Persian and validated by an expert panel including an epidemiologist, a community medicine

specialist, a pediatric ophthalmologist, two oculoplastic surgeons and a psychologist.

The study included a pilot phase to identify whether or not the questionnaire was applicable to our setting. No major modification was necessary based on the pilot results; nonetheless, according to the study protocol, the results of this phase were not included in the final analysis. Moreover, to test the repeatability of the questionnaire, it was filled for 25 children twice by a single rater and ICC was more than 0.8 in all dimensions.

Data was recorded by the three trained interviewers. The questionnaire consisted of 36 Likert scale items, where higher scores represent better function. Furthermore, demographic characteristics were recorded by 13 additional questions. For Likert scale questions, each item was transformed into a 0 to 100 scale and items within the same subscale were averaged together to yield the subscale score. A total of 11 QOL subscales were measured including functional limitation, anxiety, depression, positive well-being, social relations, general health perception, resistance/susceptibility, self-reported prior health, satisfaction with development, eye alignment concerns, and parent-child closeness. Interviews were conducted with the parents, preferably mothers, preoperatively (on the day of surgery) at the hospital and again three months postoperatively via a telephone interview. Interviewers were unaware of the results of surgery. The internal reliability of each dimension was assessed after data collection using Cronbach's alpha^[11] with values ≥ 0.7 considered as acceptable; however dimensions with an internal consistency score of at least 0.60 were also considered to be acceptable according to previous studies.^[12,13]

All statistical analyses were performed using SPSS software version 18 (SPSS Inc., Chicago, Illinois, USA). Continuous variables were described in mean values and standard deviation, while dichotomous variables were presented as counts and percentages. Paired Student's *t*-test was used to determine changes in QOL dimensions after strabismus surgery. In addition, linear regression was applied to compare the effect of strabismus surgery (as an independent variable) on improvement of QOL in various visual or ocular alignment groups (as confounding variables). In the above-mentioned linear regression model, age, area of residence (urban/rural) and mother's education level were adjusted as possible confounding variables.

RESULTS

Eighty seven children with mean age of 8.7 ± 4.1 years were recruited in the study, including 41 (47.1%) male subjects. Tables 1 and 2 present demographic, baseline and clinical characteristics of study participants. Based on preoperative best-corrected visual acuity (BCVA) in the better eye, 23 (31.1%) patients had visual impairment

Table 1. Demographics of the studied population

Demographic variables	Categories	Mean±SD n (%)
Age (year) mean±SD		8.7±4
Sex, n (%)	Male	41 (47.1)
	Female	46 (52.9)
Mother education, n (%) (years)	Illiterate	13 (14.9)
	1-5	30 (34.5)
	6-8	19 (21.8)
	9-12	18 (20.7)
Residence, n (%)	Higher education	7 (8.0)
	Urban	66 (75.9)
	Rural	21 (24.1)
Other disease, n (%)	No	72 (83.7)
	Yes	14 (16.3)
Kindergarten, n (%)	Yes	40 (48.8)
	No	42 (51.2)
Children mean±SD*		3±1

*Number of children in the family; SD, standard deviation

Table 2. Eye examinations results

Variable	Categories	n (%)
Preoperative BCVA	20/20	28 (37.8)
	20/20-20/40	23 (31.1)
	20/40-20/60	18 (24.3)
	<20/60	5 (6.8)
Preoperative deviation (PD)	10-15	9 (10.8)
	>15	74 (89.2)
Residual deviation (PD)	<5	24 (32.9)
	5-10	12 (16.4)
	10-15	23 (31.5)
	>15	14 (19.2)
Alignment correction (PD)	≤20	35 (50.7)
	>20	34 (49.3)

BCVA, best-corrected visual acuity; PD, prism diopter

(BCVA <20/40) [Table 2]. Furthermore, 74 (89.2%) patients had esotropia (ET) or exotropia (XT) greater than 15 prism diopters (PD) before surgery. There was a considerable improvement (greater than 20 PD) in ocular alignment after surgery in 49.3% of patients [Table 2].

Cronbach's alpha calculated for each subscale, for children younger or older than six years of age revealed that the questionnaire has relatively acceptable internal consistency ($\alpha > 0.6$) except for the eye alignment concerns subscale ($\alpha = 0.49$) [Table 3]. In all subscales, Cronbach's alpha coefficients were comparable between both age groups.

QOL scores are compared before and after the operation in Table 4. According to the results, a statistically significant improvement occurred in all QOL dimensions after surgery except for self-reported prior health ($P = 0.333$) and parent-child closeness ($P = 0.728$).

The results of the general linear regression model are presented in Table 5. Preoperative visual acuity, postoperative residual deviation, and the amount of eye deviation correction by surgery were the main dependent variables and QOL dimensions were considered as the outcome variables.

Improvement of each QOL dimension was not significantly different between subjects with visual impairment (VA <20/40) and those without visual impairment (VA ≥20/40), except for three subscales including positive well-being, general health perceptions, and resistance/susceptibility [Table 5]. This means that participants generally experienced significant improvement in QOL regardless of preoperative visual status.

The amount of eye alignment correction (more versus less than 20 PD) had a significant correlation with subscales of satisfaction with development (0.019) and eye alignment concerns (0.028). Participants who gained more than 20 D corrections by the current surgery attained more improvement in the above mentioned subscales of QOL.

Patients with less than 10 D residual deviations after strabismus surgery were comparable to subjects with ≥10 D residual deviation in all QOL dimensions except for positive well-being which was significantly higher in those with a successful surgical outcome [Table 5]. Therefore, residual deviation after strabismus surgery was not considered as a significant influencing factor on postoperative improvement of QOL.

DISCUSSION

Strabismus in children leads to a wide range of physical and psychosocial problems, and decreases QOL in affected patients. The most common problems expressed by many patients include poor self-esteem, disturbed interpersonal relationship, lack of self-confidence, poor self-image, and increased social anxiety.^[2-4] Most children notice their different appearance and suffer from poor cosmesis at the age of four resulting in isolation.^[8,14] For this reason, Kothari et al believe that the right age for strabismus surgery is before four years; in addition, the majority of children start interacting with their peers at this age, thus the age of four years is considered as the critical age.^[14]

We investigated the impact of strabismus surgery on QOL in children using the RAND Health Insurance Study questionnaire completed by guardians, preferably mothers. According to our results, surgery had a positive impact on most aspects of QOL and significantly improved physical, emotional and social functions. Expectedly, the eye alignment concerns subscale demonstrated the greatest improvement postoperatively. Our findings are consistent with the report by Archer et al except for the positive well-being subscale.^[1] This

QOL after Strabismus Surgery in Children; Ziaei et al

Table 3. Internal consistency of the questionnaire in different age groups

QOL dimensions (number of items in each subscale)	Cronbach α coefficients		
	All (n=87)	Age ≤ 6 (n=34)	Age >6 (n=53)
Function limitation (4)	0.891	0.864	0.917
Anxiety (3)	0.679	0.582	0.727
Depression (3)	0.763	0.839	0.690
Positive well-being (3)	0.761	0.777	0.746
Social relations (6)	0.662	0.666	0.673
General health perceptions (2)	0.863	0.807	0.877
Resistance/susceptibility (3)	0.630	0.671	0.604
Satisfaction with development (4)	0.788	0.793	0.785
Eye alignment concerns (5)	0.491	0.532	0.456
Parent-child closeness (2)	0.840	0.832	0.858

QOL, quality of life

subscale improved significantly after surgery in our study. In both studies, no significant improvement was observed in self-reported prior health and parent-child closeness subscales.

Our findings are supported by other studies, which have asserted the psychosocial benefits of surgical correction of strabismus, as well as functional improvement in adults.^[3,6,15] In particular, the positive effect of strabismus surgery on self-esteem and self-confidence have previously been demonstrated.^[3,16] Mruthyunjaya et al reported that 61% of children younger than 4 years of age had improvement in eye contact and 55% of children between 4 and 6 years of age had better self-esteem and confidence after strabismus surgery.^[6]

Although one would expect that children with an unsuccessful surgical outcome (postoperative residual deviation more than 10 PD) might have

Table 4. Comparison of quality of life dimensions before and after strabismus surgery

Subscale	Time		Difference*	P**
	Preoperation	Postoperation		
Function limitation	82.15±20.92	92.36±16.78	10.20±17.05	<0.001
Anxiety	60.28±19.19	68.61±18.15	8.33±17.88	<0.001
Depression	72.36±17.72	82.31±16.42	9.95±15.167	<0.001
Positive well-being	70.56±15.96	73.33±14.69	2.77±13.16	0.048
Social relations	68.69±30.98	79.43±11.52	10.74±31.46	0.002
General health perceptions	67.36±18.9	76.4±16.48	8.84±18.19	<0.001
Resistance/susceptibility	71.02±14.58	79.72±13.4	8.70±13.62	<0.001
Self-reported prior health	72.78±15.29	71.73±15.9	-1.78±16.82	0.333
Satisfaction with development	70.07±14.98	73.81±16.07	3.58±12.06	0.006
Eye alignment concerns	53.14±26.61	75.44±15.89	22.30±26.83	<0.001
Parent-child closeness	72.5±17.99	72.92±15.82	0.41±11.31	0.728

*Difference, The difference between quality of life dimension scores before and after operation; **P values are derived from paired t-test

Table 5. Effect of surgery on quality of life dimensions among children with different visual and ocular alignment results

	Residual deviation (ET/XT)		P	Visual impairment		P	The amount of ocular realignment		P
	<10	≥ 10		+	-		≤ 20	>20	
	Functional limitation	11.58±22.72	11.82±14.19	0.673	10.78±16.59	6.52±16.59	0.137	11.07±13.05	12.32±23.61
Anxiety	8.58±18.17	6.76±18.82	0.724	10.29±18.15	7.25±16.91	0.43	8.57±19.96	7.11±17.42	0.631
Depression	9.8±16.34	7.32±12.55	0.441	10.46±14.61	10.14±13.05	0.552	6.43±13.11	10.66±15.86	0.317
Positive well-being	4.9±10.07	-1.13±14.46	0.02	5.72±13.59	-1.09±5.79	0.024	0.24±8.21	3.43±16.55	0.422
Social relations	15.43±16.81	14.79±12.2	0.781	14.74±14.13	13.53±10.95	0.754	12.12±11.99	18.68±16.41	0.085
General health perceptions	9.85±16.46	7.43±19.65	0.600	11.52±15.78	2.27±22.7	0.036	7.86±17.17	8.33±19.43	0.795
Resistance/susceptibility	11.76±13.47	7.66±13.23	0.18	10.46±13.21	4.35±9.69	0.03	8.33±13.25	10.78±13.99	0.675
Self-reported prior health	0.83±17.96	-3.38±16.83	0.436	-2.55±17.86	0±17.68	0.486	-3.03±13.63	0.78±20.56	0.505
Satisfaction with development	5.33±12.32	1.69±10.89	0.099	5.76±13.28	0±7.77	0.103	0.54±9.02	6.62±13.58	0.019
Eye alignment concerns	25.26±20.89	24.16±19.57	0.665	21.84±31.05	24.73±22.19	0.477	19.46±18.15	29.85±21.41	0.028
Parent child closeness	-0.37±10.43	-0.34±11.96	0.957	0.49±11.72	0±9.97	0.857	-2.5±9.49	1.47±12.6	0.099

The numbers inside the table are the differences between quality of life dimension scores before and after operation; P values are derived from general linear model adjusted for the effect of age, residency area (Urban/Rural) and mother education. QOL, quality of life; ET, esotropia; XT, exotropia

lower postoperative QOL, in our study the amount of improvement was not different in those with or without this level of surgical success. A similar result was reported by Archer et al^[1] although they pointed out that the small number of cases with unsuccessful surgical outcome could have reduced study power for revealing the effect of residual deviation on QOL. On the contrary, another study which included a higher number of children with objective surgical failure (32/72) reported a positive correlation between parent satisfaction and the outcome of surgery.^[6]

In summary, the current study confirms the beneficial impact of strabismus surgery in children. Generally, children gained a significant improvement in physical and psychosocial functions after surgical realignment, and participants with a greater amount of ocular realignment (>20/PD) after surgery experienced more improvement in QOL scores. Even visually impaired children obtained significant improvement in emotional and psychosocial functions which was comparable to those with preoperative visual acuity of more than 20/40.

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Nil.

Conflicts of Interest

There are no conflicts of interest.

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