

Investigation on maternal physiological and psychological factors of cheilopalatognathus

J. Ma^{1*}, W. Zhao^{2*}, R.M. Ma^{3*}, X.J. Li¹, Z.H. Wen¹, X.F. Liu^{4#}, W.D. Hu^{1#}, C.B. Zhang^{2#}

¹Department of Aerospace Medical Equipment, Faculty of Aerospace Medicine, the Fourth Military Medical University, Xi'an

²School of Stomatology, the Fourth Military Medical University, Xi'an

³Tangdu Hospitals, the Fourth Military Medical University, Xi'an

⁴Department of psychology, Faculty of Aerospace Medicine, the Fourth Military Medical University, Xi'an (China)

Summary

Objective: Case-control study on mothers of cheilopalatognathus children was conducted, to investigate the maternal physiological and psychological factors for occurrence of cheilopalatognathus. **Materials and Methods:** One hundred ten mothers of cheilopalatognathus children who were scheduled for one-stage surgery were selected as a research group, and 110 mothers of normal children served as a normal control group at the same time. Trait Anxiety Inventory (T-AI), Life Events Scale (LES), Trait Coping Style Questionnaire (TCSQ), Type C Behavior Scale (CBS), adult Eysenck Personality Questionnaire (EPQ), and homemade general questionnaire survey were employed for the investigation. **Results:** Compared with the control group, the scores for negative event tension value, anxiety, and depressive factors were higher in the study group ($p < 0.05$); while the scores for positive event tension value, intellect, optimism, and social support factors were lower ($p < 0.05$). Regression analysis found that physiological factors included were five: education, changes in body weight during pregnancy, the intake amount of milk and beans, and intake of healthcare products, and supplementary folic acid taken or not, while the psychological factors included were four: positive event stimulation, negative event stimulation, the amount of social support, as well as introvert and extrovert personalities. **Conclusion:** The study results suggest that pregnant women's physiological and psychological factors can cause changes in cheilopalatognathus incidence, which is expected to be guidance for healthcare during pregnancy, to prevent the occurrence of cheilopalatognathus.

Key words: Cheilopalatognathus; Physiological and psychological factors; Maternal factors; Investigation.

Introduction

Cheilopalatognathus is a congenital deformity of mouth and face. Cheiloschisis is caused by the un-fusion of maxillary process with the prolabium about six weeks after conception. Simple cleft palate caused by the un-fusion of two plates of the skull that form the hard palate (roof of the mouth) during eight to nine weeks after pregnancy [1-3], and it is the most common oral and maxillofacial congenital malformations, occurring on average in about one in 700 live births in China [4, 5].

Its occurrence is due to, during embryonic development of the maxillofacial region, the effect of multiple pathogenic factors such as genetics, nutrition, endocrine, infection, physical and chemical damage, drugs, alcohol, and tobacco, leading to blockage of the normal development and fusion of the embryo, thus resulting in deformity [6-8]. Cheilopalatognathus not only seriously affects the facial appearance, but also directly affects the development as the mouth and nasal cavity are connected. Severe cheiloschisis in children will affect feeding, and the children cannot be normally fed by breastfeeding, resulting in malnutrition in children. The children will present a speech impediment during growth and development.

A large number of studies on the etiology of cheilopalatognathus have been reported, involving studies on a number of environmental factors, genetic modes, and multiple gene loci, as well as the interaction of environmental and genetic factors [9, 10]. These studies have raised a number of important clues to the etiology and have provided a solid foundation for further research. However, most of the conclusions of the study reported were inconsistent, or need to be confirmed by further study [8, 11]. In particular, what physiological and psychological factors of the mother during pregnancy will produce a significant effect on the fetus, to which there is no consistent understanding and conclusions [12-14].

Some studies have reported that, the older age of the mother is a high risk factor for occurrence of cheilopalatognathus [15]. However, more studies have not found that the elder age of the mother is a high risk factor for occurrence of it [1, 16-18]. On the contrary, some studies have found that the younger age of the mother on the contrary, would be a high risk factor for occurrence of cheilopalatognathus [19, 20]. At the same time, the intake of vasoactive drugs such as pseudoephedrine, aspirin, ibuprofen, amphetamine methamphetamine, cocaine or psychedelic drugs and smoking can lead to high incidence of cheilopalatognathus [9, 21-25]. Anti-convulsant drugs such as phenobarbital, tridione, valproic acid, and dilantin will also lead to high incidence of cheilopalatognathus [6, 26-33], but there is also questioning that this is caused by the drugs or potential epilepsy [31]. Isotretinoin may also be responsible for its

*These authors contributed equally to this work.

#Corresponding authors.

high incidence [3, 22]. The intake of sulfasalazine, naproxen, glucocorticoids, and ammonianeoferin will also have an impact. Studies have shown that the insufficient metabolism of some dietary elements in the mother can lead to cheilopalatognathus [34, 35]. The existence of the gene MTHFR 677TT and insufficient combination of folic acid may also lead to cheilopalatognathus [35], or even sufficient supply of folic acid is still unable to prevent its occurrence [23, 34]. Even the capacity of the mother to maintain red blood cell zinc concentration and inositol concentration will also affect the occurrence of cheilopalatognathus [36]. The ability of mother to maintain vitamin B6 and B12 levels as well as the ability of the fetus to use these nutrients are considered to be related to the occurrence of cheilopalatognathus [35].

Among the high risk factors inducing the occurrence of cheilopalatognathus, maternal factors become the focus of most researchers. In combination with what is described in literature, the purpose of this study was to explore the maternal risk factors for occurrence of cheilopalatognathus with a scale investigation, in order to guide healthcare during pregnancy and to prevent the occurrence of cheilopalatognathus.

Materials and Methods

Subjects

One hundred ten mothers of children with cheilopalatognathus who were scheduled to receive one-stage surgery in the Maxillo-facial Surgery Department, Dental Hospital, Fourth Military Medical University were selected as the study group, aged from 19 to 43 years, with an average age of 29.77 ± 6.04 years. One hundred ten normal mothers of healthy young children in the Obstetrics and Gynecology department were used as a normal control group by a 1:1 ratio, aged from 20 to 42 years, with a mean age of 28.44 ± 3.2 years. This study was conducted in accordance with the Declaration of Helsinki and with approval from the Ethics Committee of the Fourth Military Medical University. Written informed consent was obtained from all participants.

Methods

Using the survey and questionnaire means, the authors communicated with the parents through personalized interviews during which a detailed description of the significance of the survey and filling in the five scales was given. The authors requested that the mothers of the children independently complete the Trait Anxiety Inventory (T-AI), Eysenck Personality Questionnaire (EPQ), Life Events Scale (LES), Trait Coping Style Questionnaire (TCSQ), and Type C Behavior Scale (CBS) with the pragmatic manner for one time, and fill in a general questionnaire: a single assessment took about 40 minutes.

Statistics analysis

The SPSS13.0 software was used for the statistical analysis of the experimental results. The methods included independent-samples t test and logistic regression. A $p < 0.05$ was considered the statistically significant level. The data that did not meet the normality was transformed to meet the normal distribution before making statistical processing.

Results

Comparison of Trait Anxiety Inventory (T-AI)

With the T-AI, the score for the study group was higher than that of the control group, and the difference was statistically significant ($p < 0.05$; Table 1).

Comparison of Life Events Scale (LES)

Negative event stimulation in the study group was significantly higher than that in the control group; the positive event stimulation in the study group was significantly lower than that in the control group, and the differences in both the positive and negative life event stimuli between the two groups were statistically significant ($p < 0.05$); while in the total amount of life event stimuli, there was no significant difference between the study and control groups, and the difference was not significant statistically significant (Table 2).

Comparison of Trait Coping Style Questionnaire (TCSQ)

Score for the negative coping (NC) of the study group was lower than that in the control group, and the difference between the two groups was statistically significant ($p < 0.05$); there was no significant difference in positive coping (PC) score between the study group and control group, and the difference was not statistically significant (Table 3).

Comparison of C-type Behavior Scale score

Difference in the scores for anxiety, depression, intellect, optimism, and social support factor between the study and control groups was significant, and the difference was statistically significant ($p < 0.05$); whereas, the scores for two factors of anxiety and depression in the study group were higher than that in the control group, and lower than that in the control group for factors of intellect, optimism, and social support (Table 4).

Comparison of adult Eysenck Personality Inventory (EPI)

The differences in scores for factors of Extrovert (E), neuroticism (N), and lie (L) between the study and control groups were significant, and the differences were statistically significant ($p < 0.05$); the E factor, score of the study group was lower than that of the control group. For the N factor and the L factor, the score of the study group was higher than that of the control group; while for the P factor, difference in score of the study group and control group was not significant, and the difference was not statistically significant (Table 5).

Logistic stepwise regression analysis for maternal physiological and psychological high risk factors

The logistic stepwise regression analysis was used for screening of risk factors, and the psychological risk factors eventually entering the model included four: positive event stimulation, negative event stimulation, social support, as well as introversion and extroversion.

The regression equation was as follows: $Y = -0.318 + 0.069 \times \text{positive event stimulation} - 0.040 \times \text{negative event stimulation} + 0.196 \times \text{social support} + 0.110 \times \text{introversion and extroversion}$ (Table 6).

Table 1. — Comparison of scores for trait anxiety inventory of the study group and control group ($\bar{x} \pm s$).

Investigation item	Experimental group	Control group	t value	p value
T-AI	45.55 ± 7.595	39.49 ± 7.105	5.585	0.000

Table 2. — Comparison of scores for life event scale of the study group and control group ($\bar{x} \pm s$).

Investigation item	Experimental group	Control group	t value	p value
Quantity of stimulus of gross life event	26.25 ± 29.489	26.01 ± 28.738	0.054	0.957
Quantity of stimulus of negative events	19.74 ± 25.480	10.91 ± 18.447	2.769	0.006
Quantity of stimulus of positive events	6.51 ± 7.881	15.10 ± 16.392	-4.337	0.000

Table 3. — Comparison of scores for trait coping style questionnaire of the study group and control group ($\bar{x} \pm s$).

Investigation item	Experimental group	Control group	t value	p value
NC	29.33 ± 9.049	32.51 ± 7.321	-2.591	0.010
PC	24.71 ± 8.220	24.61 ± 5.023	0.100	0.920

Table 4. — Comparison of scores for type C behavior scale of the study group and control group ($\bar{x} \pm s$).

Investigation item	Experimental group	Control group	t value	p value
Anxiety	44.25 ± 7.008	41.53 ± 6.853	2.675	0.008
Depression	45.18 ± 6.127	41.43 ± 5.618	4.320	0.000
Anger	20.47 ± 5.358	19.28 ± 4.850	1.583	0.115
Anger introversion	13.29 ± 3.090	13.29 ± 2.816	0.008	0.994
Anger extroversion	14.06 ± 3.764	14.71 ± 3.187	-1.250	0.213
Intellect	35.74 ± 6.694	38.08 ± 4.420	-2.952	0.004
Control	15.07 ± 3.864	15.49 ± 3.023	-0.798	0.426
Optimistic	20.04 ± 3.617	21.01 ± 3.116	-1.991	0.048
Social support	14.34 ± 3.374	16.10 ± 2.534	-4.115	0.000

Table 5. — Comparison of scores for eyenck personality questionnaire scale of the study group and control group ($\bar{x} \pm s$).

Investigation item	Experimental group	Control group	t value	p value
P	4.75 ± 2.981	4.75 ± 3.054	-0.010	0.992
E	9.90 ± 3.771	12.11 ± 4.424	-3.711	0.000
N	11.39 ± 5.502	9.83 ± 5.033	1.995	0.047
L	14.01 ± 3.500	12.39 ± 3.429	3.180	0.002

Table 6. — Estimates of the independent variables and relevant parameters in the equations.

Variable	B	SE	Wald	p	OR
Quantity of stimulus of positive events	0.069	0.017	16.258	0.000	1.071
Quantity of stimulus of negative events	-0.040	0.011	13.952	0.000	0.961
Social support	0.196	0.058	11.243	0.001	1.216
Introversion-extraversion	0.110	0.045	6.056	0.014	1.116

Table 7. — Estimates of the independent variables and relevant parameters in the equations.

Variable	B	SE	Wald	p	OR
Educational background	-1.211	0.259	21.885	0.000	0.298
Weight change during pregnancy	0.792	0.366	4.688	0.030	2.208
Milk and beans intake	-0.715	0.308	5.383	0.020	0.489
Healthcare products intake	0.717	0.243	8.725	0.003	2.048
Whether folic acid was added	2.166	0.555	15.201	0.000	8.720
Constant term	-1.534	1.533	1.001	0.317	0.216

Regression analysis was conducted on the social and biological risk factors, and the risk factors eventually entering the model included five, namely: education, changes in body weight during pregnancy, intake amount of milk and beans, and intake of healthcare products, as well as folic acid supplementation or not.

The regression equation was as follows: $Y = -1.534 - 1.211 \times \text{education} + 0.792 \times \text{body weight change during pregnancy} - 0.715 \times \text{intake amount of milk and beans} + 0.717 \times \text{intake of health care products} + 2.166 \times \text{folic acid supplementation or not}$ (Table 7).

Discussion

The present results have proved that: 1) for pregnant women with a high degree of anxiety, depression, negative event stimulation, negative coping manner, neurotic personality aspects and strong lie nature, cheilopalatognathus may occur; 2) for pregnant women with active coping manner, positive event stimulation, intellect, optimism, and a high degree of social support, the incidence of cheilopalatognathus may be reduced; 3) the education qualification, folic acid supplementation or not, intake of healthcare products, intake amount of milk and beans, and body weight change during pregnancy were all important factors for cheilopalatognathus.

The screening results by logistic regression analysis of risk factors show that, folic acid supplementation or not, education qualification, intake of healthcare products, intake amount of milk and beans, and body weight change during pregnancy were all important factors for a cheilopalatognathus, and they showed cheilopalatognathus, and early childhood lip cleft palate with the possibility of the degree of influence in descending order. Among them, the level of education qualification directly affects maternal self-regulation, highly-educated mothers were generally good at self-psychological adjustment, and were not often distressed by negative emotion, and thus the incidence of cheilopalatognathus can be reduced. Generally speaking, the family environment of highly-educated mothers was relatively better, being able to provide better material conditions for their pregnancy to ensure adequate supply of nutrition, which was of positive effect for the good development of the fetus.

Body weight changes during pregnancy caused restlessness in pregnant women. The oversensitivity of the pregnant women to the change would also lead to intensified anxiety; while persistent anxiety and tension would induce the secretion of adrenocorticotrophic hormone, which would increase the incidence of fetal cheilopalatognathus.

In general, supplementation of a certain amount of folic acid and healthcare products and intake of a certain amount of milk and beans during pregnancy can guarantee the balanced nutrition of pregnant women to effectively reduce the incidence of cheilopalatognathus. However, this study showed that intake of healthcare products and supplementation of folic acid had on the contrary, a negative impact on the occurrence of cheilopalatognathus in early childhood, and the possible explanation is that this might be associated with excessive anxiety in mothers of cheilopalatognathus

children during pregnancy, and the excessive anxiety and worry led them to an overdose of healthcare products and folic acid supplements in order to obtain good results. This excessive use of healthcare products and folic acid supplementation caused by anxiety covered up the act that the intake of them had a positive effect in reducing the occurrence of cheilopalatognathus in early childhood, resulting in the image of the negative impact showed in the data. Therefore, supplementation of a certain amount of folic acid and healthcare products during pregnancy, as well as intake of a certain amount of milk and beans can effectively reduce the incidence of cheilopalatognathus.

The results show that, the T-AI score in the group of cheilopalatognathus children was higher than that in the group of normal children, indicating that the anxiety level of mothers of cheilopalatognathus children was relatively high, which provides a basis for analysis of their characteristics or traits from the perspective of personality. Trait anxiety individuals often show a relatively continuous anxiety in life; for pregnant women, this ongoing anxiety would cause psychological stress in pregnant individuals, and would adversely affect the secretion of hormones and neurotransmitters, eventually leading to the generation of cheilopalatognathus in infants.

Analysis of life event stimulation showed that, negative event stimulation in the study group in life was higher than that in the control group, while the positive event stimulation in life in the study group was lower than that in the control group. This reflects the fact that, as compared to mothers of normal children, the maternal population of children with cheilopalatognathus encountered more negative event stimulation in their lives. Generally, negative life events experienced by the individuals would have a negative impact on the individuals, and would bring much psychological pressure on the individuals, accompanied by a series of adverse psychological factors such as anxiety, depression, obsession, hostility, and fear in their lives. This results in a very unfavorable environment for the development of the fetus. Therefore, the pregnant woman must be actively guided to make reasonable adjustments to their own state of mind and pay attention to prenatal care.

From the results of TCSQ, the negative coping score of maternal group of normal children was higher compared to that of maternal group of cheilopalatognathus, and there was no difference in active coping between the two groups. This may be related to the lying nature of this part of population in the maternal group of cheilopalatognathus children that was higher in terms of personality lie. Due to the relatively high lying nature of maternal group of cheilopalatognathus children, they deliberately avoided this part of the negative information when answering the questionnaire, eventually leading to these pseudo-images of lower score on positive coping of the group and no significant differences between the two groups.

At the same time, the scores for anxiety and depressive factor of mothers of cheilopalatognathus children in CBS were consistently higher than that of the control group of mothers of normal children, and intellect, optimism, and social support factors in the CBS were significantly lower than

that in the control. In addition, there was no significant difference in scores for anger, introversive and extroversive anger, and control factors between the two groups. Thus, there was a more obvious tendency for type C behavior in the maternal group of the cheilopalatognathus children, which has played a negative impact on the occurrence of cheilopalatognathus symptoms in young children. The analysis showed that they demonstrate more widespread and deeper anxiety and depression in their daily lives, which was related to the lack of intellect in them to face conflict and frustration of the event. Meanwhile, relative lack of optimism promoted the manifestation of the type C behavior. In addition, they felt less social support. This on one hand may reflect the fact that they received less social support; on the other hand, it is more likely that their subjective sensitivity to social support given by the surrounding population was poor. The former reflects the adverse impact of external factors on the manifestation of type C behavior; the latter is more likely to reflect the higher expectations of maternal group of children with cheilopalatognathus for social support as compared with maternal groups of normal children; thus it is difficult for them to obtain subjective satisfaction from the general social support, which explains the impact of this phenomenon on the fact that mothers of cheilopalatognathus children showed more common type C behavior. With regards to the result that there was no significant difference in anger, introversive and extroversive anger between the two groups, analysis showed that it was related to the consistent degree of anger control in the two groups.

Results of EPQ questionnaire score showed that score for introversive and extroversive dimension of mothers of cheilopalatognathus children was significantly higher, indicating that the personality traits of mothers of cheilopalatognathus children tend to be introversive. This type of individuals is accustomed to introspection, relatively would pay more attention to inner experience, making it easy to be in a continuously anxious and depressive state, thus negatively impacting fetal development. Score for neuroticism of mothers of cheilopalatognathus children was also significantly higher, which indicates the cheilopalatognathus mother was not only in a negative state of mind at this stage of pregnancy, they would often feel anxiety, fear, melancholy and worry about their daily lives, and there would be a strong emotional response, so that a more irrational behavior would occur, which was closely linked with their corresponding personality traits. However, the score for mental quality dimension of both populations showed no significant difference, which reflects that although it has been affected by negative factors, the mother's behavior and mental performance of the cheilopalatognathus children were still within the normal range, and there would be less unusual behaviour. Score for lie dimension of mothers of cheilopalatognathus children was significantly higher than that in the control group. This indicates that after the birth of cheilopalatognathus children, the mother would have larger mental pressure, and the sensitivity to the negative information would generate psychological discomfort. As a positive and effective solution could not be found, the correspon-

ding avoidance mechanism would be activated in face of the negative information.

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Address reprint requests to:
X.F. LIU, M.D.
Department of Psychology
Faculty of Aerospace Medicine
Fourth Military Medical University
Changle Western Road 17#
Xi'an 710032 (People's Republic of China)
e-mail: xufenglucn@126.com