Original Article

Associations between depressive and anxiety levels and allergic rhinitis in children: a cross-sectional study

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ABSTRACT

Objective: To investigate the associations between the depressive and anxiety levels and allergic rhinitis (AR) in children. **Methods:** Children less than 15 years old admitted to our hospital from April 2017 to December 2019 were enrolled in this study, including 692 AR children in the patient group and 713 normal individuals in the control group. The Screen for Child Anxiety Related Emotional Disorders (SCARED) was used to detect their depressive and anxiety levels, and the Middle Childhood Temperament Questionnaire (MCTQ) was used to evaluate their dominant affective temperaments. The comparisons of scale scores between these groups, and the correlation analysis between SCARED scores and MCTQ scores were conducted. **Results:** The mean SCARED scores of the patient group were significantly higher than the control group ($P < 0.05$). The patient group also had more AR children with the depressive temperament and anxious temperament than the control group ($P<0.01$). Strong correlations were found between the SCARED scores and MCTQ scores.

Conclusion: The AR children had obvious depressive and anxious trends than non-allergic children. Screening the temperaments and detecting the depression and anxiety symptoms were imperative for AR children, especially for those with depression and anxious moods.

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Introduction

Allergic rhinitis (AR) is a type of inflammatory disease in the upper respiratory tract, which affects approximately 10%-40% of the global children worldwide. Its incidence is increasing in the past decades mainly due to the various challenge of stimuli, such as irritants, allergens, pathogens, pollen, and air pollutants. These allergic sources result in the nasal symptoms included itching of nose, sneezing, nasal obstruction, and rhinorrhea, which exerts negative impacts on the children's quality of life[1].

Studies have shown that the symptoms of AR were not limited to respiratory system, and non-nasal symptoms were also commonly occurred in AR patients. Especially, mental disorders such as dyssomnia, depression, and anxiety had higher incidence in AR patients aged 12-15 years than that in the normal individuals, which may affect the children's learning capabilities, attentions, and behaviors[2,3]. Moreover, depression seems to be more prevalent in patients with AR, and such psychological stress may further aggravate the symptoms of AR[4,5]. Antidepressant drugs, such as imipramine, levocetirizine, and desipramine have also shown anti-allergic actions to alleviate the AR symptoms, and they may be utilized to treat AR patients with depression and anxiety[5]. However, the associations between depression and anxiety and AR in children remains unclear.

In this study, we aim to investigate the role of depression and anxiety in the risk of children's AR by a cross-sectional study. Hopefully, we could provide convincing evidence of the association between depression and anxiety and AR in children, which may shed new lights on the benefits of antidepressants on children with AR.

Methods

Study participants

This study enrolled children less than 15 years old admitted to E.N.T. Department of our hospital from April 2017 to December 2019. A total of 692 AR children were enrolled in the patient group. The diagnosis of AR was determined by the Allergic Rhinitis and Its Impact on Asthma (ARIA) guidelines[6]. Briefly, allergic rhinitis is clinically defined as a symptomatic disorder of the nose induced after allergen exposure by an IgE-mediated inflammation. Symptoms of allergic rhinitis include rhinorrhoea, nasal obstruction, nasal itching and sneezing which are reversible spontaneously or with treatment. Postnasal drip mainly occurs either with profuse anterior rhinorrhoea in allergic rhinitis or without significant anterior rhinorrhoea in chronic rhinosinusitis. Preschool children may just have nasal obstruction. The diagnosis was performed by well-trained professional pediatric otolaryngology doctors

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with experience in AR. They were all hospitalized due to AR and received standardized care based on the clinical practices used in our hospital. The exclusion criteria for the patient group were patients who had mental illness, chronic diseases other than AR, or the history of psychotropic medication. Furthermore, 713 normal individuals less than 15 years old with no history of psychiatric illness or mental disorder and non-allergic diseases were enrolled in the control group. All participants provided detailed medical history, and received physical examination, and routine laboratory tests. And the parents of these participants all signed a written informed consent form. Ethical approval was obtained from the Ethics Committee of Shanxi Children's Hospital (Shanxi, China).

Psychological testing

All study participants underwent psychological testing to evaluate their depressive and anxiety levels. We used the Screen for Child Anxiety Related Emotional Disorders (SCARED), a 41-item parent and child report scale for children (aged 8-16 years)[7]. The child version was used to assess the children's own anxiety by their own answers. And their parents were asked to fill the parent-reported scale in terms of their child's anxiety. The total score was calculated as a sum of the 5 subscales (panic disorder, generalized anxiety disorder, separation anxiety, social anxiety, and school avoidance). A score of 25 or greater indicated that the child may had an anxiety disorder.

Moreover, the Middle Childhood Temperament Questionnaire (MCTQ) was used to evaluate the dominant affective temperament for children. It was a 99-item questionnaire for assessing the nine temperament categories of children aged between 8 and 12 years old[8]. In this study, we mainly focused on the depressive temperament and anxiety temperament of children. The number and total scores of children who had these two temperaments was recorded and performed in the next analysis.

Statistical analysis

All data were recorded with SPSS software (SPSS version 22.0, SPSS). The normally distributed data were presented as means ± standard errors. The frequency and percentage (%) were used for categorical variables. Data were analyzed by two-tailed independent t-test or the Mann Whitney U test for the comparison between patient group and control group, and categorical data were tested using the chi-square test. The Spearman correlation analysis was conducted to examine the association between children's anxiety and depression scale scores and temperament subtype scores. The Spearman correlation coefficients was interpreted as: $0 \leq r < 0.3$: low correlation; $0.3 \leq r < 0.5$: fair correlation; $0.5 \leq r < 0.7$: moderately strong correlation; $r \geq 0.7$: very strong correlation. Statistical analysis was conducted by SPSS software (SPSS version 22.0, SPSS). The level of significance was set to $p < 0.05$.

Results

Demographic Characteristics

In total, 1405 participants were included in this study. There were 692 children with AR in the patient group, and 713 healthy children in the control group. Table 1 showed the baseline characteristics of these participants. Mean age of these volunteers was 11.31 (standard deviation = 2.78) years and 11.49 (standard deviation = 2.57) years in the patient and control groups, respectively. Moreover, age in the patient group ranged from a minimum of 8 years to a maximum of 14 years, and the minimum age was 9 and the maximum age was 14. In the patient group, a total of 356 patients were male, and 336 patients were female. And in the control group, 389 males and 324 females participated in this study. There were no statistically significant differences between the patient and control groups in terms of gender and age ($P > 0.05$).

SCARED scores and MCTQ type

All participants filled out the SCARED questionnaire, and we calculated the SCARED total score and the score of each subscale (Table 2). The mean SCARED scores of these volunteers was 27.37 (standard deviation = 2.21) and 22.05 (standard deviation = 2.25) in the patient and control groups, respectively, which exhibited significant difference ($P < 0.05$). Regarding the scores of subscales, the scores of panic disorder, generalized anxiety disorder, separation anxiety, social anxiety, and school avoidance were higher in the patient group than the control group ($P < 0.05$). Most importantly, the SCARED scores of patient group was beyond 25, which demonstrates the children with AR had obviously potential anxiety.

All participants filled out the MCTQ. Table 3 showed the temperament type of children divided by MCTQ. There were 105 and 43 individuals had depressive temperament in the patient group and the control group, respectively. Furthermore, there were 113 and 56 children had anxious temperament in the patient group and the control group, respectively. The patient group also had

Table 1. The general characteristics of the patient and control groups.

Characteristics	Patient group (n=692)	Control group (n=713)	P value
Age, years			
Mean±SD	11.31± 2.78	11.49± 2.57	0.813
Median (min-max)	11.00 (8.00-14.00)	12.00 (9.00-14.00)	
Gender			
Male	356	389	0.24
Female	336	324	
Course of disease (years)	1.4±0.2		
Degree of rhinitis (n)			
mild	133		
moderate/severe	559		
Use of rhinitis medication	681		
Use of antidepressant medication	456		

Table 2. Comparison of patient and control groups regarding SCARED score.

Characteristics	Patient group (n=692)	Control group (n=713)	P value
SCARED total score	27.37 ± 2.21	22.05 ± 2.25	<.001
Panic disorder	3.81 ± 0.73	3.04 ± 0.71	<.001
Generalized anxiety disorder	7.24 ± 0.65	6.09 ± 0.69	0.037
Separation anxiety	5.83 ± 0.52	4.36 ± 0.57	<.001
Social anxiety	7.19 ± 0.67	6.42 ± 0.62	0.023
School avoidance	3.30 ± 0.31	2.14 ± 0.34	0.034

Table 3. Comparison of patient and control groups regarding MTCQ

Characteristics	Patient group (n=692)	Control group (n=713)	x^2	P value
Depressive	105	43	31.14	<.001
Not depressive	587	670		
Anxious	113	56	23.84	<.001
Not anxious	579	657		

Abbreviation: MCTQ, Middle Childhood Temperament Questionnaire.

Table 4. Correlation of SCARED Total and Subscale Scores and MCTQ scores in the patient group.

Variables	SCARED total score	Panic disorder	Generalized anxiety disorder	Separation anxiety	Social anxiety	School avoidance	Depressive temperament	Anxious temperament
SCARED total score	-	-	-	-	-	-	-	-
Panic disorder	0.632*	-	-	-	-	-	-	-
Generalized anxiety disorder	0.478*		-	-	-	-	-	-
Separation anxiety	0.671*	0.554	0.578*	-	-	-	-	-
Social anxiety	0.754*	0.356	0.782*	0.658*	-	-	-	-
School avoidance	0.803*	0.314	0.763*	0.632*	0.783*	-	-	-
Depressive temperament	0.814*	0.305	0.765*	0.685*	0.624*	0.593*	-	-
Anxious temperament	0.827*	0.269	0.773*	0.641*	0.791*	0.671*	0.691*	-

The Spearman correlation analysis was performed to investigate the association between SCARED scores and MCTQ scores. The value in the tables was r value. Abbreviation: MCTQ, Middle Childhood Temperament Questionnaire. *P<0.05.

more AR children with the depressive temperament and anxious temperament than the control group (P<0.01).

Correlation analysis between SCARED scores and MCTQ scores

The Spearman correlation analysis was performed to investigate the association between SCARED scores and MCTQ scores in the patient group (Table 4). There were strong correlations between the SCARED scores, the score of social anxiety, school avoidance, depressive temperament, and anxious temperament ($r > 0.7$, $P < 0.05$). The generalized anxiety disorder also showed strong positive correlations with social anxiety, school avoidance, depressive temperament, and anxious temperament ($r > 0.7$, $P < 0.05$). Moreover, the score of social anxiety also showed strong positive correlations with school avoidance and anxious temperament ($r > 0.7$, $P < 0.05$). However, the score of panic disorder did not exhibit any associations with the scores of other terms.

Discussion

In this hospital-based cross-sectional study, we aim to investigate the association between the depressive and anxiety levels and AR in children. And we found the depressive and anxiety levels in children with AR was significantly higher than that in healthy children. The children with AR seem to have more depressive and anxious temperaments. The smoking behavior may contribute to the increased risk of fractures for post-menopausal women. Pediatricians and parents should pay attention to the socioemotional development of children with AR.

AR is a common chronic inflammatory disease that can obviously affect patients' qualities of life[9]. It is also one of the most common causes of the allergic condition[10]. Previous studies have shown that allergy could disrupt the patients' sleep by troublesome symptoms, less disease control, and negative mental conditions, such as anxiety and depression[11]. Especially, many studies focus on the relationship between allergic diseases and depressive and anxious levels. For instance, a study conducted on 51 patients with unipolar or bipolar depression found that their allergies scores significantly associated with their anxiety scores[12]. And a study conducted on 3,831 participants found that 17.2% patients with active rhinitis symptoms had depressive disorders, while the control group was only 8.3%[13]. Another study conducted on 12,171 patients with self-reported allergies revealed that these allergy sufferers had greater panic disorders and social phobias than controls. These findings were similar to this research. We found that children with AR had higher SCARED total scores than the control group, and the score of each subscale was also higher in the patient group than the control group (Table 1). Moreover, the number of patients with depressive and anxious temperaments was significantly higher than that of control group, which demonstrates that AR children seems to be more predisposed to depression and anxiety compared to the control group (Table 2). These results extended previous findings on the cognitive and mental health impact of patients with AR.

Most intriguingly, our study found that there was an obviously correlation between SCARED scores and MCTQ scores (Table 3). Given that the affective temperament characteristics were widely considered as subthreshold clinical indications of mental disorders[14], we assumed that temperament can be identified as a specific

risk factor to the development of anxiety and depression for AR children. To be specific, we found that the depressive temperament and anxious temperament had strong positive correlations with the SCARED scores, the generalized anxiety disorder, and the social anxiety ($r > 0.7$, $P < 0.05$), which indicates that the identification of AR children with depressive and anxious temperaments could contribute to the early psychological prevention and intervention.

Psychological and psychiatric intervention was imperative to improve life qualities of AR patients, and one of the methods was the use of psychotropic drugs. Studies have shown that increased depressive scores were significantly associated with the levels of inflammatory cytokines and poor sleep quality[15]. In vivo studies, it has been found that desipramine, as a kind of tricyclic-antidepressant drugs, has anti-allergic actions via reducing allergen-specific immunoglobulin E (IgE) and inflammatory cytokines[16]. Antidepressant prescriptions may be an effective approach to treat or alleviate the symptoms of AR, especially for those patients with depressive and anxious moods, and even suicide thoughts[17]. Moreover, a professional mental consultation should be recommended during the treatment for the AR patients with depressive and anxious temperaments. The suicidal ideation or unrevealed intent or plan should be concerned by caregivers, families, and psychosocial counselors[4]. And the AR patients with the history of certain conditions (psychotic depression, bipolar disorder, treatment-resistant depression, or anxiety disorder) should be given both psychological and psychiatric interventions. Through these therapeutic and preventive interventions, it may contribute to the potential reduction in morbidity of AR and improvement in quality of life.

Although this study enriched the evidence of the associations between depressive and anxiety levels and AR in children by a cross-sectional study, several limitations should also be mentioned. Firstly, our study was a single-center study so that the samples were still relatively insufficient. Further multi-center prospective studies should be conducted to verify our conclusion. Secondly, although we have found the correlations of depressive and anxiety in different scales, some unknown factors not included in this study, such as suicide thoughts and the history of psychiatric drugs. A more comprehensive evaluation requires the collection of more patient information in the future. Thirdly, the potentially effects of psychological and psychiatric interventions should also be investigated in the further studies. And the long-term outcomes and costs are also should be concerned. Forth, the Middle Childhood Temperament Questionnaire (MCTQ) was used to evaluate the dominant affective temperament for children aged between 8 and 12 years old. However, the age of the included patients in this study was up to 15 years old.

Conclusion

In conclusion, the depressive and anxiety levels were significantly higher in children with AR. Screening the temperaments and detecting the depression and anxiety symptoms were imperative for AR children, especially for those with depression and anxious moods.

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Conflict of interest

None.

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