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Anxiety and depression in allergic rhinitis patients during COVID-19 pandemic in Wuhan, China

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Abstract

Background: During COVID-19 pandemic, many allergic rhinitis (AR) patients stopped their treatment including pharmacotherapy and allergen immunotherapy.

Objective: This study aimed to investigate the anxiety and depression and general effect of COVID-19 pandemic on AR patients' psychological status in Wuhan, China.

Methods: In October 2019, 222 outpatients suffering from AR in our department and 133 healthy controls were enrolled. All participants were asked to finish the Self-Rating Anxiety Scale (SAS) and Self-Rating Depression Scale (SDS) questionnaire. The demographic characteristics and the severity of AR symptoms were recorded. In April 2020, the AR patients and healthy controls were re-contacted to finish the questionnaires by telephone or online. The SAS and SDS scores in AR patients and healthy controls and the correlation with other variables were analyzed.

Results: For AR patients, the SAS and SDS scores were significantly higher than healthy controls. Meanwhile, the rates of anxiety and depression were 24.8% and 19.4% respectively. The education level and symptoms severity were correlated with SAS and SDS scores. Ninety-eight AR patients and 56 healthy controls finished the questionnaires after COVID-19 pandemic. The AR patients' SAS and SDS scores were lower than before COVID-19 pandemic and were correlated with AR symptom scores. The scores of healthy controls were not different with before COVID-19 pandemic.

Conclusions: The occurrence of anxiety and depression is common in AR patients. Severity of symptoms and low education level are the risk factors causing anxiety and depression. COVID-19 pandemic has no significant negative impact on the AR patients' psychological status.

Key words: allergic rhinitis, anxiety, depression, VAS, COVID-19

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Introduction

Allergic rhinitis (AR) is a chronic respiratory allergic disease which affect up to 40% of the population.[1,2] The prevalence of AR ranged between 8.7% to 24.1% in major cities across China and had been increasing over the last decades.[2] Although AR is not a fatal disease, it is associated with significantly reduced quality of life and psychological status.[3-6] Recent studies suggested that patients with AR have higher proportion of anxiety, depression, sleep disturbance and psychosocial problems than individuals without allergic disease.[7-9] AR may even be a risk factor for suicide.[10-12] Several studies indicated that AR symptoms was associated with quality of life impairment and anxiety.[8,13,14] However, most studies were based on one-item self-reports regarding absence or presence of affective disturbances, and therefore lacked accuracy in the evaluation of anxiety and depression in AR patients. Moreover, the occurrence and risk factors of anxiety and depression varied greatly in different regions.[15,16]

Therefore, it is essential to investigate the status of anxiety and depression among AR patients with validated tools in our region.

During COVID-19 pandemic period in Wuhan, many AR patients had to stop their treatment including symptom-relief medication and allergen immunotherapy. The fear of medical care insecurity might cause higher anxiety and depression among this population. We aimed to investigate the psychiatric status and the general effect of COVID-19 on anxiety and depression among AR patients in Wuhan, China.

Methods

Study design and study population

A cross-sectional survey was conducted from 1st October 2019 to 31st October 2019 in Tongji Hospital. A total of 244 AR patients and 133 healthy controls (matched by gender and age) were recruited for the study. Each participant of the study visited the department of allergy for evaluation of inclusion criteria. All AR subjects enrolled in our study were those who: (1) were diagnosed with AR according to the Allergic Rhinitis and its Impact on Asthma (ARIA) guidelines.[17] (2) had a history of AR for at least one year. (3) showed positive skin prick test and sIgE ≥ 0.35 KUA/L to at least one allergen in the allergen panel which contained 19 common aeroallergens in our region.[18] Patients with any other diseases including previously diagnosed mental disorders were excluded from this study.

All the AR patients and healthy controls were re-contacted by telephone or social Apps and were asked to finish the SAS and SDS questionnaires either in call or online from 8th April to 15th April. Their AR symptom scores were also recorded. The study was approved by the Independent Ethical Committee of Tongji Hospital.

Instrument

Assessment of AR symptoms

A visual analog scale (VAS) of 0-10 was used to evaluate the severity of symptoms (including sneezing, itching, rhinorrhea, and nasal congestion): "0" for "no symptoms" and "10" for "very severe symptoms".[1]

Evaluation of anxiety and depression status

Level of the subjects' anxiety and depression were measured using two well validated instruments: Zung Self-rating Anxiety Scale (SAS) and Zung Self-rating Depression Scale (SDS).[19,20] Both SAS and SDS scales contain 20 items respectively, which each answer scores 1-4 points. Sum score of all items was used which calculating the total score multiplied by 1.25, then taking the integer to get the final score. It ranges from 25 to 100 (the following scores of SAS and SDS were final scores), SAS and SDS are easily operated and widely applied. According to the score, anxiety could be divided into mild (score 50–59), moderate (60–69) and severe (≥ 70). Meanwhile, depression also could be divided into mild (score 53–62), moderate (63–72) and severe (≥ 73).[21]

Data collection

In October 2019, the data was collected from respondents using SAS and SDS, distributed as hard copies by trained research assistants. Research assistants explained the purpose of the study to respondents and obtained written consent for the questionnaire to be filled and returned within an hour. Each interview took approximate 5-10 min to complete. In April 2020, the data of SAS and SDS questionnaire were obtained by telephone interview or online Apps.

Statistical analysis

Data was entered into Microsoft excel 2013, cleaned to detect any missing or invalid variable and then imported to STATA 16.0 (USA) for analysis. Descriptive parameters, such as means and standard deviations for normally distributed continuous data, frequencies and percentages for categorical data, were calculated. Multivariable linear regression (MLR) was used to determine relationship between demographic characteristics and SAS and SDS scores, normality of continuous variables was assessed by the Shapiro-Wilk test. The Pearson chi-square test was used to determine the association between categorical variables. The 2-sample t test, paired t test and one-way ANOVA was used to evaluate the continuous variable. The comparisons among groups were performed with LSD test. All tests were performed 2-tailed, and a probability value of less than 0.05 was considered statistically significant.

Results

Characteristics of the Study Population

A total of 222 AR patients and 133 healthy controls were recruited into our study. Both groups did not differ in age, gender and education level ($P > 0.05$). The scores of SAS and SDS in AR patients were significantly higher than in healthy controls (both $P < 0.001$). (**Table 1**)

Table 1. Demographic and clinical characteristics of the study population

Characteristic	AR (n = 222)	Healthy controls (n = 133)	*P* value
Age (years)	32.78 ± 9.77	33.74 ± 9.20	0.364
Gender, N (%)			0.485
Male	105 (47.30)	68 (51.13)	
Female	117 (52.70)	65 (48.87)	
Education, N (%)			0.854
Below College	134 (60.36)	77 (57.89)	
Bachelor	77 (34.68)	50 (37.59)	
Postgraduate	11 (4.95)	6 (4.52)	
VAS score	4.42 ± 1.56	-	-
Disease duration (years)	9.44 ± 8.21	-	-

Table 1. (Continued)

Characteristic	AR (n = 222)	Healthy controls (n = 133)	*P* value
Allergen profile,N (%)			
Mono-allergen	131 (59.01)		
Multi-allergen	91 (40.99)		
SAS score	41.82 ± 10.53	30.83 ± 6.74	0.000*
SDS score	41.27 ± 11.47	31.89 ± 8.36	0.000*

*$P < 0.05$

Anxiety and depression symptoms

The occurrence of anxiety and depression in AR patients were 24.8% and 19.4% respectively (shown in **Figure 1A and 1D**) while the healthy controls were 2.8% and 4.5% (both $P < 0.05$). Education level was correlated with SAS and SDS scores, bachelor and postgraduate had lower SAS and SDS scores compared to below college patients ($P < 0.05$) (shown in **Figure 1B and 1E**, **Table 2**). AR patients with severe symptoms got higher scores of anxiety and depression ($P < 0.05$) (shown in **Figure 1C and 1F**, **Table 2**).

Multi-Allergen patients had a higher SAS score compare to mono-allergen patients ($P < 0.05$) (shown in **Table 2**). Disease duration was weekly correlated with SDS score ($r = 0.2203$, $P < 0.05$). Multivariable linear regression analysis further confirmed that the education level and VAS score were significant correlated with SAS and SDS scores ($P < 0.05$). Other variables such as age, gender had no effects on SAS and SDS scores ($P > 0.05$) (**Table 3**).

Anxiety and depression during COVID-19 pandemic period

The COVID-19 pandemic was announced to be end in Wuhan and the city lifted up lockdown at 8th April. A total of 98 AR patients and 56 healthy controls responded to the telephone or online questionnaire from 8th April to 15th April. None of them had SARS-COV-2 infection. For AR patients, SAS and SDS scores were 40.34 ± 0.90 and 39.74 ± 1.08 at October 2019. After COVID-19 pandemic, the SAS and SDS score decreased to 31.08 ± 0.83 and 32.31 ± 0.87 respectively (all $P < 0.0001$) (**Figure 2A and 2B**). Meanwhile, the occurrence of anxiety and depression also decreased from 17.35% and 16.33% to 9.18% and 4.08% respectively. The decreased SAS and SDS scores were correlated with improved AR symptoms ($P < 0.001$) (**Figure 2C**).

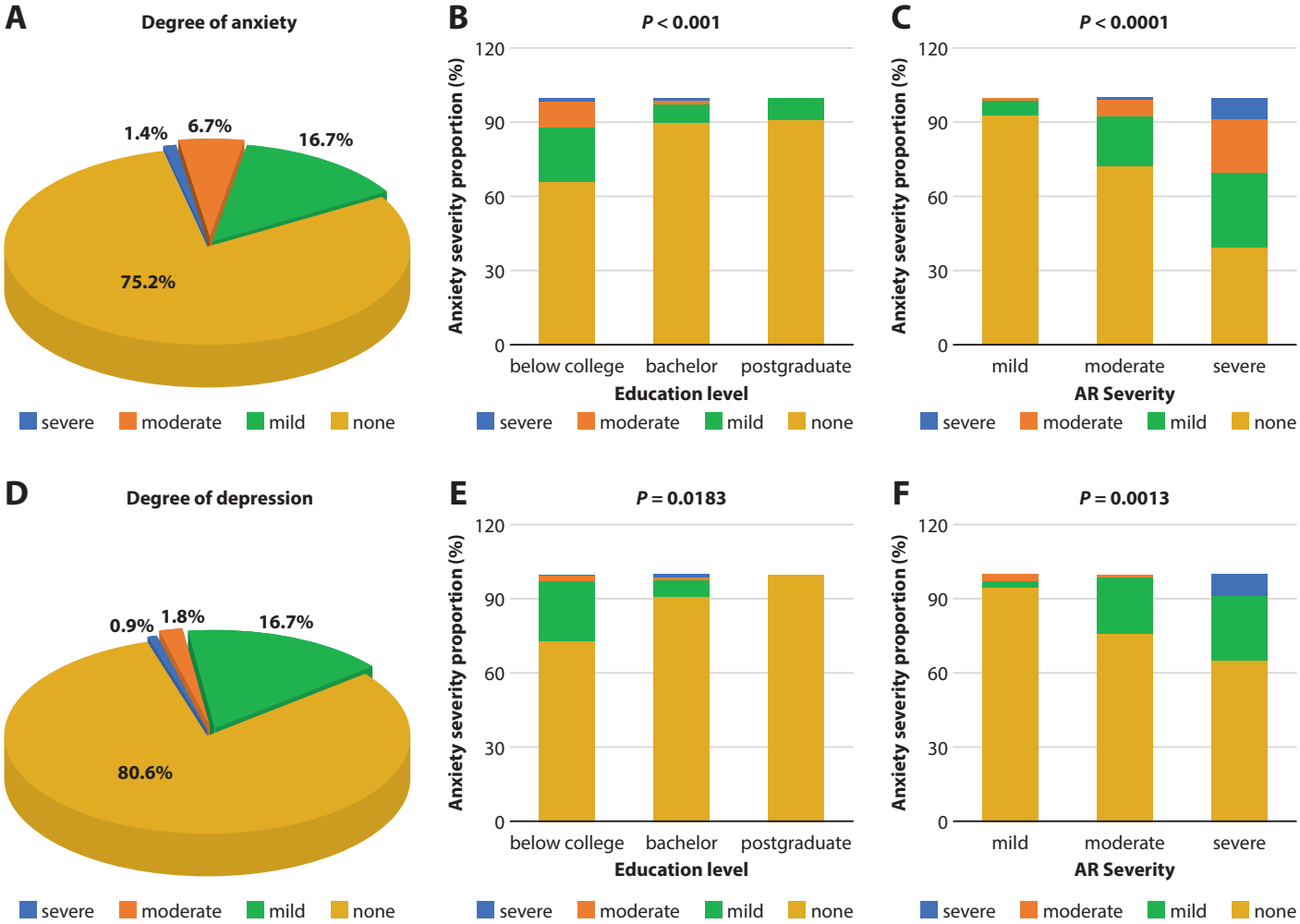

Figure 1. The distribution of the degree of anxiety (A) and depression (D) in AR patients; the proportion of anxiety (B) and depression (E) degree in different education groups; the proportion of anxiety (C) and depression (F) degree in different severity of AR patients. Anxiety and depression severity were correlated with education level and AR severity ($P < 0.05$).

Table 2. The SAS and SDS scores in different education level, AR severity and allergen profile group

Variable	SAS		SDS	
	mean ± SD	*P*	mean ± SD	*P*
Education		0.000*		0.000*
Below College	44.54 ± 11.05		43.63 ± 11.64	
Bachelor	37.88 ± 8.18		38.32 ± 10.56	
Postgraduate	36.27 ± 7.86		33.18 ± 6.85	
AR severity		0.000*		0.000*
Mild (1~3)	35.00 ± 7.54		35.61 ± 9.30	
Moderate (4~6)	43.93 ± 9.28		43.21 ± 10.98	
Severe (7~10)	50.78 ± 13.26		47.61 ± 13.55	
Allergen profile		0.019*		0.126
Mono-allergen	40.61 ± 10.69		40.53 ± 11.10	
Multi-allergen	43.57 ± 1.09		42.33 ± 11.97	

Table 3. Multiple linear regression model of SAS and SDS in AR patients

Model	SAS			SDS		
	coefficients	95%CI	*P*	coefficients	95%CI	*P*
(Constant)	26.164	18.010, 34.317	0.000*	33.510	23.896, 43.124	0.000*
Gender	1.827	-0.543, 4.197	0.130	0.530	-2.265, 3.324	0.709
Age	0.032	-0.091, 0.155	0.607	-0.046	-0.191, 0.100	0.536
Education	-4.064	-6.084, -2.044	0.000*	-4.200	-6.572, -1.809	0.001*
Disease duration	0.145	-0.001, 0.290	0.051	0.211	0.039, 0.382	0.016*
AR severity	2.886	2.132, 3.629	0.000*	2.423	1.535, 3.312	0.000*
Allergen profile	2.533	0.131, 4.936	0.039*	1.283	-1.550, 4.117	0.373

*$P < 0.05$

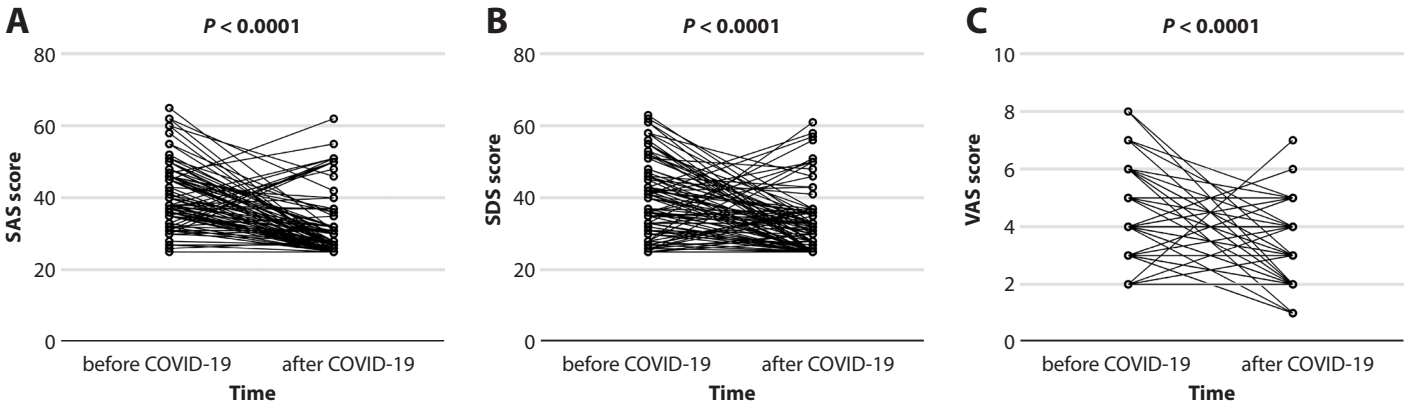

Figure 2. SAS score (A), SDS score (B) and VAS score (C) measured before and after COVID-19. Compared with that before COVID-19, the SAS score and SDS score after COVID-19 decreased ($P < 0.001$). The decreased SAS and SDS scores showed a significant correlation with improved AR symptoms. ($P < 0.001$).

Whereas the SAS and SDS scores of healthy controls were not different with before COVID-19 pandemic ($P > 0.05$). The post-hoc ANOVA analysis among the 98 AR patients after the COVID-19 pandemic further confirmed that VAS scores were significant correlated with SAS and SDS scores ($P < 0.05$). Interestingly, other variables including education level, disease duration and allergen profile which had shown effects on SAS and SDS scores at baseline turned to be no significance ($P > 0.05$).

Discussion

Psychological status is known to have an important impact on diseases outcome. The association between allergy and psychological dysfunction, anxiety, depression, and reduced ability to cope with stress has been mentioned in several studies.[22-24] One study reported the incidence rates of anxiety and depression disorder were 1.41 and 1.7 times higher in AR patients compared to non-allergic subjects.[7] Recent research revealed that stress and anxiety may enhance and prolong AR symptoms.[25] However, despite the quickly increased AR population in China in recent years, AR has been ignored for a long time by the patients and society as it is not a fatal disease. There were few studies regarding psychological characteristics of AR patients in China.[26]

Our study firstly shown the occurrence of anxiety and depression was common in AR patients in Central China. The SAS and SDS questionnaire we used in our research are the psychological measuring scales which will not affected by the factors such as age, sex, economic status, cultural background or professional.[21] The two scales have been widely used in psychiatric departments and psychological counseling clinics with satisfactory reliability, validity and utility. With these two validated scales, we found the occurrence of anxiety and depression were 24.8% and 19.4% in the AR population of our region, which indicated the anxiety and depression were common in the AR patients. Our data is similar to other allergy and psychological studies. Pearson found abnormal psychological status in the course of the classic atopic diseases such as asthma, AR and eczema. The depression in asthma patients was 5-15%, while the anxiety was up to 33%.[27] As up to 1/3 of the AR patients had psychological dysfunction, it is imperative to figure out the factors related to the processing of anxiety and depression. A multi-disciplinary team included psychologist is also recommend to optimize the management of these AR patients.

Our study revealed that the education level and AR severity scores were significantly associated with anxiety and depression. Interestingly, we found the AR patients with lower educational level got higher anxiety and depression scores, which was opposite to other studies. Early studies suggested that a higher educational level might result in a psychological disorder.[28] The discrepancy may reflected the culture and region differences in AR population, we noticed the patients with lower education level always had a relative poor knowledge of AR but a higher expectation of treatment, they tended to consult many doctors (as this is always easily available in China than in European countries) frequently if their symptoms could not be relieved in a short time. Meanwhile, patients with higher education level always had a better understanding of the diseases and shown a higher compliance to the treatment, which was helpful in alleviating anxiety and depression. We also found the severity of AR was positively correlated to the SAS and SDS scores. AR patients with severe symptoms were more tended to develop anxiety and depression. It's not surprising since previous studies have demonstrated moderate-severe AR patients had impaired sleep quality and cognitive function, which can cause irritability, fatigue and other psychological dysfunctions.[17] Another evidence of symptom severity influenced anxiety and depression was the decreasing of SAS and SDS scores significantly accompanied with the decreasing of VAS scores in those follow-up patients. Multiple regression analysis further confirmed our findings that AR severity and education level as independent variables significantly impacted both SAS and SDS scores. Thus, a detailed education program and effective treatments are essential for improving the patients' psychological dysfunction. An evidence of the importance of education program emerged from the *post-hoc* analysis that the education level and disease duration were no longer risk factors for anxiety and depression after the patients received education and initiated their treatment. We also found the allergen sensitization profile shown a weak correlation with anxiety, multi-sensitized AR patients had a higher SAS score than mono-sensitized patients. It implied anxiety and other psychological dysfunction might be driven by biological mechanisms. Several studies have reported the inflammatory cells and mediators (such as IL-6, TNF, IL-1β) contribute to the development of psychological dysfunction in AR patients.[29] However, more data are needed to elucidate the correlation and underlying mechanisms of biological factors and psychological status in these population.

We found the anxiety and depression of AR patients were not significantly influenced by COVID-19 pandemic. The AR patients had received medication and/or allergen immunotherapy since first visit in our department at Oct 2019. During the COVID-19 pandemic, the majority of patients had to stop treatments as the city was lockdown. We hypothesized the fear of medical-service insecurity might deteriorate patients' psychological status. For this reason, we conducted the SAS and SDS re-evaluation study within one week after the city lifted up lockdown. Interestingly, the occurrence of anxiety and depression were decreased after COVID-19 pandemic, which implied the pandemic had no significant negative impact on the psychological status of the AR patients. However, as it was impossible to have an ideal control group not experienced the pandemic, the absolute effect of COVID-19 on the SAS and SDS was lack. A cohort study to be conducted post COVID-19 pandemic may be an alternative solution. On the contrary, we found the decreasing of SAS and SDS were highly correlated to the decreasing of VAS score, which also re-confirmed that the symptom severity was an important factor affecting the anxiety and depression in AR patients.

There are some limitations in our study. Firstly, the patients responded to the SAS and SDS questionnaire in hard copies at baseline, while they answered the questionnaire in telephone or online after COVID-19 pandemic, which might

cause bias. Secondly, to eliminate the time-effect on our study, we acquired the data in one week after the city unlocked, only 98 patients and 56 healthy controls responded in the defined time-window. Finally, all the 98 patients and 56 healthy controls were free of SARS-CoV-2 infection, the anxiety and depression in SARS-CoV-2 infected AR patients were unclear. Interestingly, early data implied type 2 inflammatory related diseases such as allergic asthma and AR might be protective factors from SARS-CoV-2 infection, since the pre-existing condition of AR and asthma were relatively low in the COVID-19 population.[30-34] ACE2 (the receptor of SARS-CoV-2) expression were also found to be lower in the airway of AR and asthma patients compared with healthy controls.[35] However, other studies shown opposite results that the allergic diseases were high among the COVID-19 population and may result in more severe outcomes.[36,37] As this is not an epidemiological study, we cannot figure out the correlation of AR and COVID-19 as well as the psychiatric status of SARS-CoV-2 infected AR patients.

In conclusion, we firstly assessed AR patients' psychological characteristics in Central China and found anxiety and depression were common in AR patients. The education level and symptom severity were correlated with anxiety and depression. AR patients were not significantly influenced during COVID-19 pandemic. In future, a comprehensive education program and more effective treatment regimen will help to improve the anxiety and depression in AR patients.

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Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Author Contributions

- Yin Wang performed data collection, statistical analysis and writing of the paper.
- Cancan Shi , Yaqi Yang and Si Zhang performed data collection.
- Wenjing Li and Nan Huang performed statistical analysis and data interpretation.
- Rongfei Zhu supervised the data collection, statistical analysis and the writing and revision of the paper.

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