

Factors Associated With Quality of Life in Subjects With Stable COPD

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BACKGROUND: The purpose of this study was to assess the impact of bronchiectasis, anxiety and depression, and parameters of disease severity on health-related quality of life (HRQOL) in subjects with COPD. **METHODS:** Sixty-two subjects with stable COPD were selected for the study. The presence of bronchiectasis in all subjects with COPD was investigated by high-resolution computed tomography. Pulmonary function tests were performed. Dyspnea was assessed using the Modified Medical Research Council (MMRC) dyspnea scale. Psychological disorders were investigated using the Hospital Anxiety and Depression Scale (HADS), and the HRQOL was examined using the St George Respiratory Questionnaire (SGRQ). **RESULTS:** High-resolution computed tomography revealed that 44 of 62 (70.9%) subjects with COPD had bronchiectasis. There were no differences in pulmonary function tests, symptoms, activities, impact, SGRQ total scores, and HADS scores between COPD subjects with and without bronchiectasis. Pearson correlation analyses showed that there was no significant association between the presence of bronchiectasis, bronchial wall thickness, or severity of bronchial dilatation and all subscales of the SGRQ or HADS scores. Additionally, HADS scores showed significant positive association with all subscales of the SGRQ in all subjects. In linear regression analysis, a statistically significant relationship was found between the SGRQ total score and percent-of-predicted FEV₁, percent-of-predicted diffusing capacity of the lung for carbon monoxide, MMRC score, and anxiety score, but the SGRQ total score was not associated with age, body mass index, total number of hospitalizations, P_{aO₂}, or depression score. **CONCLUSIONS:** The presence of bronchiectasis in subjects with COPD does not impact HRQOL and psychological disorders. However, disease severity, dyspnea levels, and anxiety scores predict poor HRQOL. *Key words:* chronic obstructive pulmonary disease (COPD); health-related quality of life (HRQOL); anxiety; depression; bronchiectasis. [Respir Care 2015;60(11):1585–1591. © 2015 Daedalus Enterprises]

Introduction

COPD is one of the major health problems worldwide and constitutes an important cause of mortality and morbidity. COPD is defined as “a preventable and treatable disease with some significant extrapulmonary effects

that may contribute to the severity in individual patients.”¹ COPD and its associated symptoms, such as dyspnea, cough, and fatigue, cause restrictions of patients’ exercise tolerance and consequently have a major impact on their ability to carry out daily activities, thus resulting in a reduced health-related quality of life (HRQOL).²

HRQOL is a very broad concept referring to quality of life that is directly related to health or illness, and it usually includes a category related to the physical, social, and psychological impact of diseases.³ Depression and anxiety have been determined to be important predictors of poor HRQOL in subjects with COPD.⁴ A significant association among depression, anxiety, and HRQOL in subjects with COPD was shown. However, the reasons for the associations are not clear.⁵

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Bronchiectasis is a condition representing abnormal and permanent dilatation and distortion of medium-sized bronchi, usually accompanied by destruction of the airway wall. A high prevalence of bronchiectasis in subjects with COPD has been determined.^{6,7} The presence of bronchiectasis causes pulmonary infections and loss of lung function, resulting in chronic respiratory symptoms and worsening HRQOL.⁸ Both bronchiectasis and COPD may worsen HRQOL. Taken together, it is reasonable to hypothesize that the presence of bronchiectasis may be a new predictive factor for poor HRQOL in patients with COPD. However, the effect of bronchiectasis in patients with COPD on HRQOL has not yet been examined. The purpose of this study was to assess the impact of accompanying bronchiectasis, anxiety and depression, and parameters of disease severity on HRQOL in subjects with COPD.

Methods

Consecutive subjects with diagnosed COPD admitted to the polyclinic in the Department of Pulmonary Medicine at Kırıkkale University were included in this study. The diagnosis of COPD conformed to Global Initiative for Chronic Obstructive Lung Disease guidelines.⁹ To be included in the study, the subjects had to be stable, with no physical findings or symptoms suggestive of exacerbation and without therapy modifications within 6 weeks before enrollment, and they received optimum therapy according to the guidelines. Sixty-two subjects with COPD were selected for the study. Subjects completed a questionnaire on demographics, smoking history, medical history, history of hospitalizations due to COPD exacerbations, and medications. The total number of hospitalizations for COPD exacerbations and the number of hospitalizations for COPD exacerbation in the previous year were recorded. The presence of bronchiectasis in all subjects with COPD was investigated by high-resolution computed tomography (CT). Informed written consent was obtained from all subjects. The study was approved by the local ethics committee.

Clinic Measurements

Body mass index (BMI) was calculated by measuring weight and height. Arterial blood gas was measured by arterial puncture in the morning while subjects were seated (15 min) and breathing room air for at least 45 min. Pulmonary function tests and forced expiratory maneuvers using a flow-sensitive spirometer (Vmax Spectra 22, SensorMedics, San Diego, California) were performed with nose clips while subjects were seated and repeated at least 3 times according to American Thoracic Society guidelines.¹⁰ FVC, FEV₁, and FEV₁/FVC were recorded. The diffusing capacity of the lung for carbon monoxide (D_{LCO}) was measured again using the same device with a single-

QUICK LOOK

Current knowledge

COPD is the world's fourth-leading cause of mortality and is projected to be the fifth leading disease in morbidity impact by 2020. Health-related quality of life (HRQOL) is a very broad concept that refers to quality of life that is directly related to health or illness, typically including the physical, social, and psychological impact of disease. Depression and anxiety have been shown to be important predictors of HRQOL in patients with COPD.

What this paper contributes to our knowledge

Bronchiectasis was a common finding among subjects with COPD. However, the presence of bronchiectasis did not have an impact on quality of life or psychological disorders in these subjects. Severity of COPD, levels of dyspnea, and frequency of disease exacerbations did predict poor HRQOL. Both depression and anxiety also predicted poor HRQOL independently of COPD severity.

breath method. D_{LCO}/alveolar volume (D_L/V_A) values were obtained. All measurements for age, sex, and race based on a percentage of the expected value were recorded. Dyspnea was assessed using the Modified Medical Research Council (MMRC) dyspnea scale. Psychological disorders were investigated using the Hospital Anxiety and Depression Scale (HADS), and the HRQOL was examined using the St George Respiratory Questionnaire (SGRQ).

MMRC Scale

The severity of dyspnea, defined as the unpleasant sensation of labored or difficult breathing, was rated according to the MMRC scale.¹¹ Verbal descriptors in the MMRC scale start from 0 (not troubled by dyspnea) to a maximum value of 5 (dyspnea with minimum effort). The MMRC scale was administered by a physician.

Assessment of Psychological Status

Subjects were asked to fill in the self-reported HADS questionnaire. The questionnaire consisted of 14 questions, in which the overall severity of anxiety and depression was rated on a 4-point scale (0–3). Seven questions were related to anxiety, and 7 questions were related to depression.¹² The validity and reliability of the Turkish version of the HADS questionnaire were determined by Aydemir et al.¹³

Health Status Measured by the SGRQ

The SGRQ is designed to measure the impact of chest diseases on HRQOL and well-being.¹⁴ The validity and reliability of the Turkish version of the SGRQ were determined by Polatlı et al.¹⁵ The responses to its 50 questions can be aggregated into an overall score, with 3 subscores for symptoms, activities, and impact. The number of response choices per question varies between 2 and 5. Responses are weighted, and scores are calculated by dividing the summed weights by the maximum possible weight and expressing the result as a percentage, with 0% being the best possible score and 100% the worst. The weights appear to be similar in different countries and languages.

High-Resolution CT

Chest CT scans were performed on a SeleCT scanner (Picker International, Haifa, Israel) in high-resolution mode according to the method of Mayo et al.¹⁶ The matrix size was 512×512 , and the scanning time was 2.1 s. Subjects were examined while supine during full deep inspiration with their arms held over their heads. Images were recorded at a window width of 1,600 Hounsfield units and at a window level of -600 Hounsfield units. No intravenous contrast medium was administered. Section cuts of 1.5-mm thickness at 10-mm increments were obtained throughout the lungs.

Two observers independently scored each of 6 areas (right upper lobe, right middle lobe, right lower lobe, left upper lobe, lingula, and left lower lob) during inspiratory CT scanning. The presence and extent of bronchiectasis on the basis of established CT criteria were scored as: grade 0 = no disease, grade 1 = localized bronchiectasis affecting one or part of one bronchopulmonary segment (localized), grade 2 = bronchiectasis in more than one bronchopulmonary segment (extensive), and grade 3 = generalized cystic bronchiectasis. The average severity of bronchial dilatation was quantified relative to the adjacent pulmonary arteries as: grade 0 = no bronchiectasis, grade 1 = 100–200% arterial diameter, grade 2 = 200–300% arterial diameter, and grade 3 = >300% arterial diameter. Bronchial wall thickness was quantified relative to the adjacent pulmonary arteries as: grade 0 = none, grade 1 = < 50% arterial diameter, grade 2 = 50–100% arterial diameter, and grade 3 = > 100% arterial diameter.^{17,18}

Statistical Analysis

All clinical parameters were summarized by descriptive statistics, and results were expressed as mean \pm SD. COPD subjects with and without bronchiectasis were compared using an unpaired *t* test or the Mann-Whitney test when

Table 1. Relation Between COPD Stage and Bronchiectasis Severity

	Presence of Bronchiectasis		Bronchial Wall Thickness		Bronchial Dilatation Severity	
	r	P	r	P	r	P
COPD stage	0.03	.7	−0.009	.9	0.05	.6

Statistical significance of $P < .05$.

appropriate for continuous parameters and using a chi-square test for categorical variables. The relationship between all subscales of the SGRQ or HADS scores and the presence of bronchiectasis, bronchial wall thickness, severity of bronchial dilatation, percent-of-predicted FEV₁, percent-of-predicted FEV₁/FVC, percent-of-predicted D_{LCO}, percent-of-predicted D_L/V_A, P_{aO₂}, MMRC score, and total number of hospitalizations was examined by Pearson correlation analyses in all subjects. Additionally, the association between all subscales of the SGRQ and HADS scores was investigated by Pearson correlation analyses in all subjects. The relationship between total SGRQ score and age, BMI, percent-of-predicted FEV₁, percent-of-predicted D_{LCO}, P_{aO₂}, MMRC score, total number of hospitalizations, and HADS scores was investigated according to multivariate linear regression analysis in subjects with COPD.

Results

During the study period, 62 consecutive subjects with COPD were included. High-resolution CT revealed that 44 of 62 (70.9%) subjects with COPD had bronchiectasis, and the extension of bronchiectasis was greater in the lower lobes (28/44, 63.6%). There was no relationship between COPD stage and the presence of bronchiectasis, bronchial wall thickness, or severity of bronchial dilatation (Table 1).

Comparison of Characteristics, Pulmonary Function Tests, and Questionnaire Scores Between Subjects With Bronchiectasis and Without Bronchiectasis

In Table 2, the distribution of all subjects with COPD according to stage is shown, and the characteristics of subjects with and without bronchiectasis are compared. The mean age, sex, BMI, smoking history, and disease duration did not differ between subjects with and without bronchiectasis. There were no differences in percent-of-predicted FEV₁, percent-of-predicted FEV₁/FVC, percent-of-predicted D_{LCO}, percent-of-predicted D_L/V_A, P_{aO₂}, MMRC score, total number of hospitalizations, symptoms, activi-

Table 2. Comparison of Characteristics, Pulmonary Function Tests, and Questionnaire Scores Between Subjects With and Without Bronchiectasis

Parameter	COPD Subjects Without Bronchiectasis (<i>n</i> = 18)	COPD Subjects With Bronchiectasis (<i>n</i> = 44)	<i>P</i>
Stage 1, <i>n</i> (%)	11 (17)	5 (8)	
Stage 2, <i>n</i> (%)	19 (30)	8 (12)	
Stage 3, <i>n</i> (%)	12 (19)	4 (6)	
Stage 4, <i>n</i> (%)	2 (3)	1 (1)	
Age, mean ± SD y	59.9 ± 10.1	58.9 ± 9.7	.7
Males, <i>n</i> (%)	18 (100)	43 (97.7)	.5
Pack-years history, mean ± SD	41.3 ± 16.0	43.7 ± 18.6	.6
COPD duration, mean ± SD y	8.1 ± 4.6	12.2 ± 22.2	.4
BMI, mean ± SD kg/m ²	27.4 ± 6.5	25.8 ± 4.2	.2
FEV ₁ , mean ± SD % predicted	64.3 ± 22.6	62.7 ± 20.9	.7
FEV ₁ /FVC, mean ± SD % predicted	59.6 ± 11.6	57.0 ± 12.0	.4
D _{LCO} , mean ± SD % predicted	84.6 ± 16.6	81.6 ± 21.7	.6
D _L /V _A , mean ± SD % predicted	98.0 ± 18.8	99.4 ± 18.4	.8
P _{aO₂} , mean ± SD mm Hg	70.8 ± 9.2	69.1 ± 10.9	.5
MMRC score, mean ± SD	2.4 ± 1.3	2.4 ± 1.0	.9
Total No. of hospitalizations, mean ± SD	1.4 ± 2.0	1.5 ± 2.2	.8
SGRQ score, mean ± SD			
Symptoms	43.1 ± 22.8	49.2 ± 21.2	.3
Activities	45.2 ± 28.5	54.4 ± 21.4	.3
Impact	22.3 ± 17.8	31.2 ± 21.6	.1
Total	32.6 ± 20.2	41.1 ± 20.8	.2
HADS score, mean ± SD			
Anxiety	4.2 ± 4.2	6.1 ± 4.5	.1
Depression	5.1 ± 4.0	7.3 ± 4.5	.09

Statistical significance of *P* < .05.

BMI = body mass index

D_{LCO} = diffusing capacity of the lung for carbon monoxide

D_L/V_A = D_{LCO}/alveolar volume

MMRC = Modified Medical Research Council

SGRQ = St George Respiratory Questionnaire

HADS = Hospital Anxiety and Depression Scale

ties, impact, total SGRQ scores, and HADS scores between COPD subjects with and without bronchiectasis.

Relationship Between All Components of the SGRQ or HADS Scores and Bronchiectasis Severity and Clinical and Functional Parameters

The relationship between all subscales of the SGRQ or HADS scores and the presence of bronchiectasis, bronchial wall thickness, and bronchial dilatation severity was investigated by Pearson correlation analyses. Pearson correlation analyses showed that there were no significant associations between the presence of bronchiectasis, bronchial wall thickness, or bronchial dilatation severity and SGRQ symptoms, activities, impact, and total scores or HADS scores (Table 3).

Pearson correlation analyses showed that there were significant negative associations between SGRQ symptoms, activities, impact, and total scores and percent-of-predicted FEV₁, percent-of-predicted FEV₁/FVC, P_{aO₂}, percent-of-

predicted D_{LCO} and between SGRQ symptoms, impact, and total scores and percent-of-predicted D_L/V_A. In addition, SGRQ symptoms, activities, impact, and total scores had significant positive associations with MMRC dyspnea scores and the total number of hospitalizations. Furthermore, SGRQ activities, impact, and total scores had significant positive associations with the number of hospitalizations in the previous year (see Table 3).

Pearson correlation analyses again showed that there was a significant negative relationship between the depression score and percent-of-predicted FEV₁, percent-of-predicted FEV₁/FVC, and P_{aO₂}. However, anxiety scores were not associated with any parameters (see Table 3).

Factors Determining Total SGRQ Scores in Subjects With COPD

In Pearson correlation analyses, both depression and anxiety scores showed significant positive associations with SGRQ symptoms, activities, impact, and total scores (Table

Table 3. Correlation Between All of Components of the SGRQ or HADS Scores and Bronchiectasis, Bronchial Wall Thickness, Bronchial Dilatation Severity, FEV₁, FEV₁/FVC, D_{LCO}, D_L/V_A, P_{aO₂}, MMRC Scores, and Number of Hospitalizations

	Presence of Bronchiectasis		Bronchial Wall Thickness		Bronchial Dilatation Severity		% of Predicted FEV ₁		v% of Predicted FEV ₁ /FVC		v% of Predicted D _{LCO}		% of Predicted D _L /V _A		P _{aO₂}		MMRC Score		Total No. of Hospitalizations		No. of Hospitalizations in Previous Year	
	r	P	r	P	r	P	r	P	r	P	r	P	r	P	r	P	r	P	r	P	r	P
SGRQ																						
Symptoms	0.13	.3	0.05	.6	0.11	.3	-0.42	.001	-0.42	.001	-0.3	.01	-0.28	.04	-0.38	.003	0.56	<.001	0.44	.001	0.23	.08
Activities	0.12	.3	0.13	.3	0.15	.2	-0.50	<.001	-0.50	<.001	-0.47	<.001	-0.24	.07	-0.43	.001	0.74	<.001	0.52	<.001	0.32	.01
Impact	0.18	.1	0.20	.1	0.16	.2	-0.58	<.001	-0.58	<.001	-0.41	.002	-0.29	.03	-0.42	.001	0.62	<.001	0.43	.001	0.33	.01
Total	0.14	.2	0.17	.2	0.16	.2	-0.57	<.001	-0.57	<.001	-0.46	.001	-0.30	.03	-0.45	<.001	0.71	<.001	0.50	<.001	0.34	.01
HADS																						
Depression	0.22	.09	0.12	.3	0.16	.2	-0.27	.04	-0.29	.02	-0.19	.1	-0.14	.3	-0.31	.01	0.20	.1	0.17	.2	0.17	.1
Anxiety	0.18	.1	0.14	.3	.11	.4	-0.009	.9	-0.06	.6	0.03	.7	-0.11	.4	-0.02	.8	-0.01	.9	-0.06	.6	0.09	.4

Statistical significance of $P < .05$.
 SGRQ = St George Respiratory Questionnaire
 HADS = Hospital Anxiety and Depression Scale
 D_{LCO} = diffusing capacity of the lung for carbon monoxide
 D_L/V_A = D_{LCO}/alveolar volume
 MMRC = Modified Medical Research Council

4). In linear regression analysis, a statistically significant negative relationship was found between SGRQ total scores and percent-of-predicted FEV₁ ($P = .02$) or percent-of-predicted D_{LCO} ($P = .02$). A statistically significant positive relationship was found between SGRQ total scores and MMRC dyspnea scores ($P < .001$) and anxiety scores ($P < .001$) when the relationship between SGRQ total score and age, BMI, percent-of-predicted FEV₁, P_{aO₂}, percent-of-predicted D_{LCO} MMRC dyspnea score, total number of hospitalizations, and HADS scores were analyzed in all subjects. However, SGRQ total scores were not associated with age, BMI, P_{aO₂}, total number of hospitalizations, or depression score (Table 5).

Discussion

This study showed that HRQOL was markedly impaired with the parameters of COPD severity. The health status of patients with COPD is influenced by many different factors. However, this study showed that the presence of bronchiectasis in subjects with COPD did not influence HRQOL. Furthermore, psychological disorders in subjects with COPD were not associated with the presence and severity of bronchiectasis. However, anxiety disorders in subjects with COPD were associated with all subscales of the SGRQ according to both simple correlation and linear regression analyses.

This study showed that all subscales of the SGRQ were significantly associated with the total number of hospitalizations, dyspnea score, and tests measuring the COPD severity, such as percent-of-predicted FEV₁, percent-of-predicted FEV₁/FVC, percent-of-predicted D_{LCO}, and P_{aO₂}, in Pearson correlation analyses. Previous studies also showed that HRQOL was significantly associated with COPD severity.^{19,20}

In our study, both Pearson correlation and linear regression analyses showed that dyspnea severity was the most significant predictor of components of the SGRQ in subjects with COPD. Dyspnea evaluation is an important factor in predicting HRQOL of patients with COPD. Similarly, Justine et al²¹ showed that dyspnea rating influenced HRQOL to a greater extent than the physiological measurement of lung function. Additionally, Obaseki et al²² found that self-reported breathlessness and weight loss were independent predictors of low HRQOL scores in subjects with COPD. The number of hospitalizations due to disease exacerbations was not independently associated with HRQOL according to linear regression analysis. On the other hand, Villar Balboa et al²³ found that exacerbations and dyspnea were the best individual factors related to HRQOL. Solem et al²⁴ showed that the severity and frequency of disease-related exacerbations in subjects with COPD were associated with poor HRQOL and work productivity and activity impairment. The symptoms in pa-

Table 4. Correlation Between All Components of the SGRQ and HADS Scores

HADS	SGRQ							
	Symptoms		Activities		Impact		Total	
	r	P	r	P	r	P	r	P
Depression	0.50	< .001	0.42	.001	0.51	< .001	0.51	< .001
Anxiety	0.33	.01	0.41	.001	0.41	.001	0.43	.001

Statistical significance of $P < .05$.
 SGRQ = St George Respiratory Questionnaire
 HADS = Hospital Anxiety and Depression Scale

Table 5. Predictors of SGRQ Total Score in Subjects With COPD

Predictor	SGRQ Total		
	B	P	R ² (%)
Intercept	0.001		75
Age	−0.14	.1	
BMI	0.05	.4	
FEV ₁	−0.25	.02	
D _{LCO}	−0.18	.02	
P _{aO₂}	−0.02	.8	
MMRC	0.46	< .001	
Total No. of hospitalizations	0.02	.8	
Anxiety score	0.37	< .001	
Depression score	0.03	.7	

Statistical significance of $P < .05$.
 SGRQ = St George Respiratory Questionnaire
 BMI = body mass index
 D_{LCO} = diffusing capacity of the lung for carbon monoxide
 MMRC = Modified Medical Research Council

tients with more exacerbations may be more intense, and their HRQOL may be poorer.

We found that psychological disorders such as depression and anxiety in subjects with COPD were significantly associated with all subscales of the SGRQ according to the simple correlation, but only anxiety disorders were independently associated with SGRQ total scores in linear regression analysis. Ng et al²⁵ reported that depressed subjects with COPD had significantly worse HRQOL in all subscales of the SGRQ. Andenaes et al²⁶ reported a significant relationship between depression scores and the respiratory-specific SGRQ impact subscale in subjects with COPD. Coventry et al²⁷ found that anxiety at baseline was significantly correlated with respiratory-specific HRQOL after hospitalization, but this did not remain significant at 1-y follow-ups of subjects with COPD. Oga et al²⁸ showed that anxiety was correlated with respiratory-specific HRQOL at 1- and 5-y follow-ups of subjects with COPD. Our results are consistent with the litera-

ture and indicate that psychological disorders predict future HRQOL.

The prevalence of bronchiectasis in subjects with COPD in this study was 70.9%. Additionally, HRQOL, airway obstruction levels, dyspnea severity, and HADS scores did not differ between subjects with and without bronchiectasis. Furthermore, all subscales of the SGRQ and HADS scores were not associated with the presence and severity of bronchiectasis. Bronchiectasis accompanying COPD did not impact HRQOL or HADS scores according to these results. Additionally, the presence and severity of bronchiectasis were not associated with COPD stage according to our results.

Patel et al²⁹ found that the frequency of bronchiectasis was 50% in subjects with moderate-to-severe COPD and that the presence of bronchiectasis was associated with increased bronchial inflammation, more severe and more frequent exacerbations, greater colonization of the bronchial mucosa by potentially pathogenic microorganisms, and a higher degree of functional impairment. Martínez-García et al³⁰ examined the factors associated with bronchiectasis in subjects with moderate-to-severe COPD. They found that bronchiectasis was present in 53 of 92 (57.6%) subjects with moderate or severe COPD and that the presence of bronchiectasis in a high-resolution CT scan may indicate the presence of more advanced airway dysfunction. These results confirmed an association between these disorders. O'Leary et al³¹ showed that neither anxiety nor depression level was associated with the extent of bronchiectasis in a CT scan. However, anxiety and depression were quite common in 34% of subjects with bronchiectasis, and this elevated the scores for anxiety, depression, or both. Olveira et al⁸ determined that depression and anxiety symptoms were significant predictors of HRQOL in subjects with bronchiectasis, independent of respiratory involvement, sex, age or other variables. In our study, bronchiectasis frequency in subjects with COPD was higher than reported in the literature because of the inclusion of cylindrical bronchiectasis in the COPD group combined with bronchiectasis.

Conclusions

In summary, bronchiectasis is common among subjects with COPD. The presence of bronchiectasis may be expected to have a negative impact on HRQOL in subjects with COPD. However, the presence of bronchiectasis has no adverse impact on HRQOL and psychological disorders in these subjects. COPD severity, dyspnea levels, and exacerbation frequency predict poor HRQOL. In addition, anxiety disorders predict poor HRQOL. Thus, psychological disorders, especially in patients with severe COPD, should be examined over regular periods.

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