Quality of Life and Bronchial Hyper-Responsiveness in Subjects With Bronchiectasis: Validation of the Seattle Obstructive Lung Disease Questionnaire in Bronchiectasis

Emel Bulcun MD, Mesut Arslan MD, Aydanur Ekici MD, and Mehmet Ekici MD

BACKGROUND: Bronchiectasis can adversely affect quality of life. However, the tests examining quality of life in bronchiectasis are not sufficient. We examined the validity of a measure designed for COPD, the Seattle Obstructive Lung Disease Questionnaire (SOLQ), in bronchiectasis. In addition, we aimed to compare the quality of life of subjects with bronchiectasis and bronchial hyper-responsiveness with that of those without to identify the effective factors. METHODS: We studied 78 subjects with clinically stable bronchiectasis and 41 healthy controls matched for age and sex. Subjects were assessed by the SOLQ. A detailed history, physical examination, the Medical Outcomes Study 36-Item Short Form questionnaire, the Hospital Anxiety and Depression Scale, and spirometric measurements were obtained. RESULTS: Cronbach α coefficients, which reflected internal consistency, were >0.70 for all SOLQ components except for treatment satisfaction. SOLQ component scores correlated with all of the component scores of the Medical Outcomes Study 36-Item Short Form questionnaire and the Hospital Anxiety and Depression Scale, confirming their concurrent validity. All SOLQ scores correlated positively with percent-of-predicted FEV_1, whereas the physical function, treatment satisfaction, and emotional function correlated negatively with the exacerbation frequency in Pearson analysis. Emotional and physical functions were positively associated with percent-of-predicted FEV_1 in linear regression analysis. Compared with subjects without bronchial hyper-responsiveness, those with bronchial hyper-responsiveness had lower FEV_1/FVC and more exacerbations/y. Compared with bronchiectasis subjects without bronchial hyper-responsiveness, those with bronchial hyper-responsiveness had significantly lower SOLQ, physical function, and coping skills scores but not emotional function and treatment satisfaction. CONCLUSIONS: The SOLQ is a valid instrument for determining quality of life in subjects with bronchiectasis. Subjects with bronchiectasis and bronchial hyper-responsiveness had a poorer quality of life, lower baseline spirometric values, and more frequent exacerbations, suggesting more severe disease. *Key words: bronchiectasis; health-related quality of life; bronchial hyper-responsiveness; spirometric values; exacerbation number.* [Respir Care 2015;60(11):1616–1623. © 2015 Daedalus Enterprises]

Introduction

Since antibiotic therapy and vaccination have been widely used in medical practice, the incidence of bronchiectasis has steadily decreased.[1] However, in developing countries, it is still an important health problem. Bronchiectasis is defined as pathologically irreversible, abnormal dilatation of the bronchi.[2,3] Common symptoms of patients with bronchiectasis are cough with sputum and dyspnea. Dyspnea varies in severity and is often associated with wheezing, which may simulate asthma.[4] Subjects with clinical features of bronchial hyperexcitability had significantly lower pulmonary function in bronchiectasis.[5] The pathophysiology of bronchiectasis may result in the development of dyspnea and decreased exercise tolerance, both of which can impact a patient's quality of life and ability to perform activities of daily living.[6]

Although studies have demonstrated that bronchiectasis impairs health-related quality of life (HRQOL), little agree-

The authors are affiliated with the Department of Pulmonary Diseases, Faculty of Medicine, Kırıkkale University, Kırıkkale, Turkey.

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Correspondence: Emel Bulcun MD, Department of Pulmonary Disease, Faculty of Medicine, Kırıkkale University, 71100 Kırıkkale, Turkey. E-mail: emelbulcun@hotmail.com.

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ment has developed regarding the factors that contribute to impaired HRQOL. Psychosocial factors may also contribute to impairment. Studies have shown that both depression and anxiety are associated with worse health outcomes.[7,8] It was demonstrated that symptoms of depression and anxiety are common in subjects with bronchiectasis, and they appear to be associated with dyspnea, low FEV_1, and chronic respiratory failure.[9] The Seattle Obstructive Lung Disease Questionnaire (SOLQ) is commonly used to examine quality of life of patients with COPD. However, this questionnaire has not used for evaluation of HRQOL of patients with bronchiectasis. We thought that the SOLQ would be compatible with the Medical Outcomes Study 36-Item Short Form questionnaire (SF-36) in assessment of HRQOL of patients with bronchiectasis. Furthermore, bronchiectasis patients with bronchial hyperresponsiveness have more severe disease than those without. Thus, bronchial hyper-responsiveness in patients with bronchiectasis may adversely impact HRQOL. The purpose of this study was to assess the reliability and validity of the SOLQ for subjects with bronchiectasis. Additionally, we aimed to compare the HRQOL of subjects with bronchiectasis and bronchial hyper-responsiveness with the HRQOL of those without to identify the effective factors in HRQOL.

QUICK LOOK

Current knowledge

In developing countries, bronchiectasis remains an important health problem. Bronchiectasis is defined as pathologically irreversible, abnormal dilatation of the bronchi, with the most common symptoms being cough with sputum and dyspnea. The pathophysiology of bronchiectasis may result in the development of dyspnea and decreased exercise tolerance, both of which can impact a patient's quality of life and ability to perform activities of daily living.

What this paper contributes to our knowledge

The Seattle Obstructive Lung Disease Questionnaire (SOLQ) demonstrated good repeatability in a subgroup of stable subjects over a short period of time and good internal consistency when applied to subjects with bronchiectasis. The SOLQ may be used for evaluation of health-related quality of life (HRQOL) in patients with bronchiectasis in daily practice. Subjects with bronchiectasis and bronchial hyper-reactivity had poorer HRQOL, lower baseline spirometric values, and more exacerbations, suggesting more severe disease.

Methods

Study Design

This study included 78 subjects with clinically stable bronchiectasis and 41 healthy controls matched for age and sex. Patients attending the clinic who had been diagnosed with bronchiectasis by high-resolution computed tomography (CT) were approached to take part in the study. All subjects signed informed consent forms, and the study was approved by the local ethics committee.

A detailed history, physical examination, and spirometric measurements were obtained from each subject. Clinical stability was required in all subjects, and it was defined as the absence of clinical worsening beyond normal daily variations with no need for increasing habitual or rescue medication for at least 4 weeks before evaluation.

Exclusion criteria included the presence of cystic fibrosis, cardiac disorder, cognitive impairment, treatment with systemic corticosteroids, or respiratory tract infection in the previous 4 weeks. The etiology of bronchiectasis in the study was not investigated. As a control group, we studied healthy subjects of similar age and sex who had never smoked. No participant suffered from any other chronic disease (COPD, diabetes mellitus, liver cirrhosis, thyroid dysfunction, rheumatoid arthritis, chronic renal failure, and/or psychiatric disorders) or was taking any type of medication.

Quality of Life

The SOLQ is a 29-question instrument developed to measure physical and function, coping skills, and treatment satisfaction. Individual items of the SOLQ are scored on a simple linear scale, with a response of 1 representing the lowest function. Responses to questions on the scale are summed into a raw score and then transformed to a normalized score ranging from 0 to 100. This normalized score is calculated by subtracting the lowest possible score from the raw score and then dividing this by the range of possible scores and multiplying by 100. Each of the 4 scales is scored separately, with a score of 100 representing the highest possible function. Currently, no overall score can be generated.[10] First, the SOLQ was translated into Turkish by a specialist in social psychology and 2 other clinicians in chest disease areas, and the final text was constructed using their common sentences. Second, the test was administered to a small group of 7 subjects with bronchiectasis. After this administration, some words that caused misunderstanding were changed.

The general HRQOL instrument used in this study was the SF-36 (version 1.0). The SF-36 measures the health domains of physical functioning, role limitations due to physical health problems, bodily pain, general health, vitality, social function, role limitations due to emotional

problems, and mental health. These domains can be further aggregated into 2 summary scores for physical and mental health.[11,12]

Assessment of Psychological Status

Subjects were asked to fill in the self-reported Hospital Anxiety and Depression Scale (HADS) questionnaire. The questionnaire consists of 14 questions, in which the overall severity of anxiety and depression is rated on 4-point scale (0–3). Seven questions are related to anxiety and 7 to depression.[13]

Bronchial Provocation Test

A histamine inhalation test was performed on subjects to determine the level of bronchial hyper-reactivity. Before testing, inhaled and oral bronchodilators were withheld for at least 12 h. Inhaled corticosteroids were not withheld. Histamine solution (diphosphate salt, Sigma, Deisenhofen, Germany) was prepared in sterile isotonic saline. The histamine challenge test was performed according to a standardized procedure.[14] Pulmonary function was measured by a flow-sensing spirometer connected to a computer for data analysis (Jaeger, Würzburg, Germany). Each subject inhaled increasing (doubling) concentrations of histamine (0.03–16 mg/mL) nebulized by a dosimeter with an output of 0.9 ± 0.3 mL/puff (Dosimeter APS Pro, Jaeger) until FEV_1 was reduced by 20% from baseline values. Bronchial response to histamine was expressed as the provocative dose causing a 20% fall in FEV_1 (mg/mL) and calculated using the same computer program (LAB 4.3, Jaeger).

An exacerbation was defined as subjective and persistent (>24 h) deterioration in at least 3 respiratory symptoms, including cough, dyspnea, hemoptysis, and increased sputum purulence or volume. For the purposes of this study, exacerbation frequency was defined as the number of times in the previous year a subject had these symptoms as a result of bronchiectasis.

High-Resolution CT

CT scans of the chest were performed on a Picker SeleCT (Haifa, Israel) in high-resolution mode according to the method of Mayo et al.[15] 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 lobes (the lingula was regarded as a separate lobe) at inspiratory CT scanning. The presence and extent of bronchiectasis, on the basis of established CT criteria, were scored as follows: 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 follows: grade 0 = no bronchiectasis, grade 1 = 100–200% arterial diameters, grade 2 = 200–300% arterial diameters, and grade 3 = >300% arterial diameter. Bronchial wall thickness was quantified relative to the adjacent pulmonary arteries as follows: grade 0 = none, grade 1 = <50% arterial diameter, grade 2 = 50–100% arterial diameters, and grade 3 = >100% arterial diameter.[16,17] The CT diagnosis of mosaic perfusion was established according to the area of low attenuation compared with adjacent normal lung parenchyma.

Statistical Analysis

The internal consistency measures the degree of association between the questionnaire items. It was tested to determine the Cronbach α coefficient. A minimum of 0.7 for the Cronbach α coefficient was accepted as the minimum reliability coefficient for group comparison. Test-retest reliability, which measured the ability of the SOLQ to produce consistent scores over a short period of time (at 2 weeks), and the intraclass correlation coefficient were determined. Concurrent validity of the SOLQ was assessed by comparing its component and total scores with the SF-36 and HADS overall scores and the clinical parameters.

The relationship between variables was determined by Pearson rank correlation analysis. Subjects with bronchiectasis were categorized in terms of the presence or absence of bronchial hyper-reactivity. The differences between groups were assessed with the Student *t* test and Mann-Whitney *U* test as appropriate. Multiple linear regression analysis was performed with the quality-of-life scores as the dependent variables and the extent of bronchiectasis, HADS scores, percent-of-predicted FEV_1, sex, age, bronchiectasis duration, exacerbation frequency, and presence of bronchial hyper-reactivity as predictor variables. Predictor variables were entered into the multivariate model using a stepwise procedure. Clinical data were expressed as mean ± SD. $P < .05$ was considered statistically significant.

Results

Compared with the control group, subjects with bronchiectasis had lower SF-36 physical component scores

Table 1. Clinical Features of Control Group and Subjects With Bronchiectasis

Clinical Feature	Control Group ($n = 41$)	Subjects With Bronchiectasis ($n = 78$)	P
Age, mean ± SD y	49.0 ± 14.0	48.1 ± 13.5	.6
Females/males, n	18/23	46/32	.1
FEV_1, mean ± SD % predicted	93.5 ± 13.4	78.5 ± 18.4	<.001
FEV_1/FVC, mean ± SD	0.90 ± 0.07	0.76 ± 0.13	<.001
SF-36 score, mean ± SD			
Physical component	75.8 ± 30.1	58.5 ± 25.2	.001
Mental component	71.5 ± 19.9	60.5 ± 19.9	.005

SF-36 = Medical Outcomes Study 36-Item Short Form questionnaire

(58.5 ± 25.2 vs 75.8 ± 30.1, $P = .001$) and SF-36 mental component scores (60.5 ± 19.9 vs 71.5 ± 19.9, $P = .005$) (Table 1).

Reliability

The internal consistency, as measured by the Cronbach α coefficient, was >0.7 in all components (physical function [$\alpha = 0.72$], emotional function [$\alpha = 0.91$], and coping skills [$\alpha = 0.74$]) of the SOLQ except for the treatment satisfaction component ($\alpha = 0.62$).

Concurrent Validity

The SOLQ component scores significantly correlated with the scores of the SF-36 physical and mental health summary and the HADS (Table 2). The HADS overall score was an important predictor of all SOLQ component scores.

Table 2 shows the results of the correlation analysis between the SOLQ component scores and the clinical parameters. FEV_1 correlated with all SOLQ component scores. The physical function scale correlated slightly better with percent-of-predicted FEV_1 than did the scales for emotional function and coping skills. Exacerbation frequency also correlated with all SOLQ component scores except for the coping skills component.

In the linear regression model, there was a negative relationship between all SOLQ component scores except for the coping skills component and exacerbation frequency in all subjects. Additionally, there was a negative relationship between all SOLQ component scores except for the emotional function component and the HADS overall score. Furthermore, physical and emotional function components were significantly positively associated with percent-of-predicted FEV_1 (Table 3).

Test-Retest Reliability (Repeatability)

Table 4 shows the mean component scores of the SOLQ obtained for 40 subjects to whom the questionnaire was administered twice during the baseline visit and at 2 weeks. The scores of all SOLQ components were not significantly different between the 2 visits ($P > .05$). The intraclass correlation coefficients were sufficient for all components and ranged from 0.65 to 0.83. Clinical features of the subjects with bronchiectasis with and without bronchial hyper-reactivity are shown in Table 4. Subjects with bronchial hyper-reactivity had a mean age similar to those without bronchial hyper-reactivity (49.0 ± 14.0 vs 44.6 ± 11.3 y). Subjects with bronchiectasis and bronchial hyper-reactivity had a prevalence of smoking similar to those without bronchial hyper-reactivity (23.0% vs 41.2%, $P = .11$). The baseline spirometric values of subjects with bronchial hyper-reactivity were lower than those of subjects without bronchial hyper-reactivity. The extent of parenchymal abnormalities of bronchiectasis on CT scan was not different between groups (Table 5). Of subjects with bronchiectasis, 78.2% had bronchial hyper-reactivity. The presence of bronchial hyper-reactivity was correlated with exacerbation frequency ($r = 0.24$, $P = .03$) and FEV_1 ($r = -0.44$, $P = <.001$). Compared to subjects with bronchiectasis without bronchial hyper-reactivity, those with bronchial hyper-reactivity showed significantly lower SF-36 mental and physical health summary scores.

Bronchiectasis subjects with bronchial hyper-reactivity had significantly lower SOLQ, physical function, and coping skills scores but not emotional function and treatment satisfaction compared with those without bronchial hyper-reactivity. Stepwise multivariate linear regression indicated that the presence of bronchial hyper-reactivity was an important determinant of quality of life scores (SF-36) (Table 6). The importance of the presence of bronchial hyper-reactivity was decreased with the addition of the exacerbation number to the multivariate model (Table 7).

Discussion

The SF-36 physical and mental health summary and HADS overall scores significantly correlated with the SOLQ component scores. Cronbach α coefficients, which reflect internal consistency, were >0.70 for all SOLQ components except for the treatment satisfaction. All SOLQ scores correlated positively with percent-of-predicted FEV_1, whereas physical function, treatment satisfaction, and emotional function correlated negatively with exacerbation frequency. However, while the importance of the relationship between SOLQ scores and exacerbation frequency was maintained, the significance of the relationship between the coping skills and treatment satisfaction

Table 2. Results of Correlation Analysis Between SOLQ Component Scores and Domains of SF-36 and HADS at Baseline for 78 Stable Subjects With Bronchiectasis

	SOLQ Scores*							
	Physical Function		Emotional Function		Coping Skills		Treatment Satisfaction	
	r	*P*	r	*P*	r	*P*	r	*P*
SF-36								
Physical health summary score	0.53	<.001	0.55	<.001	0.47	<.001	0.40	<.001
Mental health summary score	0.52	<.001	0.53	<.001	0.46	<.001	0.50	<.001
HADS overall score	−0.66	<.001	−0.41	<.001	−0.70	<.001	−0.37	<.001
% predicted FEV_1	0.40	<.001	0.39	<.001	0.33	.003	0.26	.02
Exacerbation frequency	−0.30	.007	−0.28	.01	−0.19	.09	−0.29	.009

* r and *P* values were determined by Pearson rank correlation analysis.
SOLQ = Seattle Obstructive Lung Disease Questionnaire
SF-36 = Medical Outcomes Study 36-Item Short Form questionnaire
HADS = Hospital Anxiety and Depression Scale

Table 3. Determinants of SOLQ Scores in Multivariate Linear Regression Models

Determinant	SOLQ Scores							
	Physical Function		Emotional Function		Coping Skills		Treatment Satisfaction	
	β	*P*	β	*P*	β	*P*	β	*P*
Age	−0.04	.5	0.07	.4	−0.18	.02	−0.08	.4
Male sex	0.26	.004	0.23	.03	0.23	.006	0.20	.08
HADS overall score	−0.50	<.001	−0.22	.053	−0.56	<.001	−0.34	.002
% predicted FEV_1	0.18	.03	0.28	.009	0.10	.2	0.14	.1
Exacerbation frequency	−0.20	.01	−0.23	.02	−0.08	.2	−0.24	.02

SOLQ = Seattle Obstructive Lung Disease Questionnaire
HADS = Hospital Anxiety and Depression Scale

Table 4. Test-Retest Reliability (Repeatability) of the SOLQ in 40 Stable Subjects With Bronchiectasis at Baseline Assessment

SOLQ Component	First Visit	2 Weeks	ICC	*P**
Physical function score	56.9 ± 25.7	53.6 ± 28.2	0.83	.1
Emotional function score	69.2 ± 24.5	68.0 ± 278	0.71	.7
Coping skills score	64.4 ± 22.6	64.3 ± 26.9	0.81	.9
Treatment satisfaction score	57.1 ± 17.0	55.2 ± 18.6	0.65	.4

Data are mean ± SD.
* By paired-sample *t* test.
SOLQ = Seattle Obstructive Lung Disease Questionnaire
ICC = intraclass correlation coefficient

components of the SOLQ and airway obstruction decreased in the linear regression analysis. The scores of all SOLQ components were not significantly different between the 2 visits. The intraclass correlation coefficients were sufficient for all components. Accordingly, the SOLQ is a valid and reliable instrument for determining HRQOL in subjects with bronchiectasis.

Another important finding of this study is the presence of poorer HRQOL in subjects with bronchiectasis compared with the control group. Furthermore, the SOLQ physical function and coping skills domains and SF-36 mental and physical health summary components were lower in subjects with bronchial hyper-reactivity than in those without. In addition, the presence of bronchial hyper-reactivity was associated with poorer baseline spirometric values and more exacerbations. It was shown that bronchial hyper-reactivity in subjects with bronchiectasis was associated with more severe airway obstruction.[18]

Bronchiectasis subjects with and without bronchial hyper-reactivity had similar extents of parenchymal abnormalities on CT scan. In the multivariate model, the presence of bronchial hyper-reactivity was an important predictor for poorer HRQOL in subjects with bronchiectasis. The importance of the presence of bronchial hyper-

Table 5. Clinical Features of Subjects With Bronchiectasis According to Bronchial Hyper-Responsiveness

Clinical Feature	Subjects With Bronchial Hyper-Responsiveness	Subjects Without Bronchial Responsiveness	*P*
Age, mean ± SD y	49.0 ± 14.0	44.6 ± 11.3	.2
Duration of diseases, mean ± SD y	15.6 ± 13.9	14.1 ± 12.2	.6
Female/males, *n*	37/24	9/8	.5
FEV_1, mean ± SD % predicted	75.9 ± 17.1	89.9 ± 19.4	.006
FEV_1/FVC, mean ± SD	0.74 ± 0.13	0.82 ± 0.12	.04
Exacerbations/y, mean ± SD	2.3 ± 2.4	1.0 ± 1.3	.03
SOLQ score, mean ± SD			
Physical function	48.07 ± 22.9	65.5 ± 30.1	.01
Emotional function	63.9 ± 20.3	66.07 ± 31.2	.7
Coping skills	57.9 ± 20.2	71.7 ± 22.8	.01
Treatment satisfaction	56.1 ± 19.03	59.2 ± 17.6	.5
SF-36 score, mean ± SD			
Physical component	50.4 ± 20.7	66.5 ± 24.5	.008
Mental component	63.4 ± 20.6	76.02 ± 16.5	.02
Extent of bronchiectasis score	5.4 ± 3.8	5.1 ± 2.4	.7
Bronchial dilatation score	2.2 ± 0.8	2.5 ± 08	.2
Bronchial wall thickness score	1.9 ± 1.0	2.1 ± 0.9	.5
Mosaic perfusion, %	52.5	29.4	.09

SOLQ = Seattle Obstructive Lung Disease Questionnaire
SF-36 = Medical Outcomes Study 36-Item Short Form questionnaire

Table 6. Determinants of Quality of Life in Multivariate Linear Regression Models

Determinant	SF-36 Physical Health Summary Score*		SF-36 Mental Health Summary Score†	
	β	*P*	β	*P*
Intercept		<.001		<.001
Male sex	0.35	.001	0.40	<.001
Bronchiectasis duration	−0.21	.03	−0.23	.02
Age	−0.002	.9	0.01	.9
Presence of bronchial hyper-reactivity	−0.25	.01	−0.22	.03
Smoking	0.14	.2	0.08	.4

* $r^2 = 0.25$.
† $r^2 = 0.28$.
SF-36 = Medical Outcomes Study 36-Item Short Form questionnaire

Table 7. Determinants of Quality of Life in Multivariate Linear Regression Models With Addition of Number of Exacerbations as an Independent Variable

Determinant	SF-36 Physical Health Summary Score*		SF-36 Mental Health Summary Score†	
	β	*P*	β	*P*
Intercept	<.001	<.001		
Total high-resolution CT score	−0.01	.9	−0.12	.1
% predicted FEV_1	0.30	.003	0.21	.01
Male sex	0.25	.009	0.28	.001
Bronchiectasis duration	−0.13	.1	−0.16	.055
Age	−0.11	.2	−0.10	.1
Presence of bronchial hyper-reactivity	−0.05	.6	−0.005	.9
Exacerbations/y	−0.34	.001	−0.49	<.001
Smoking	0.08	.4	0.03	.7

* $r^2 = 0.41$.
† $r^2 = 0.52$.
SF-36 = Medical Outcomes Study 36-Item Short Form questionnaire
CT = computed tomography

reactivity was decreased with the addition of the exacerbation number to the multivariate model. Accordingly, it may be considered that by increasing the number of exacerbations, bronchial hyper-responsiveness may adversely affect the HRQOL. We could not find a study investigating the impact of the presence of bronchial hyper-reactivity on HRQOL in subjects with bronchiectasis. In principle, one could expect a negative relationship between the HRQOL and the extent of bronchiectasis on CT scan. However, the HRQOL was not associated with the extent of bronchiectasis in this study. Thus, the extent of bronchiectasis appears to emphasize different aspects of disease severity in bronchiectasis.

Similarly, in a study by Eshed et al,[19] the total CT score of 46 subjects with bronchiectasis did not correlate with St George Respiratory Questionnaire scores. In addition, subjects with more advanced disease on high-resolution CT significantly differed in their St George Respiratory Ques-

tionnaire scores from subjects with milder bronchiectasis. Lee et al[20] found a strong association between the 6-min walk test, all components of the St George Respiratory Questionnaire, and the SF-36 physical scores in subjects with bronchiectasis. Martínez-García et al[21] showed that dyspnea, FEV_1, and daily sputum production are the most relevant HRQOL-conditioning variables in subjects with bronchiectasis. However, few data exist regarding the effective factors in HRQOL in patients with bronchiectasis. Furthermore, we are not aware of any research comparing the HRQOL of subjects with and without bronchial hyper-reactivity. Additionally, several studies concluded that exacerbations in subjects with bronchiectasis can adversely affect HRQOL, and treatment of exacerbations might lead to improvement in quality of life.[22-24] It is clear that this issue needs more study.

People live with chronic diseases that can adversely affect their HRQOL. Numerous factors may lead to poorer HRQOL in lung diseases. Information on the impact of chronic diseases on HRQOL is limited. These results lead us to conclude that bronchial hyper-reactivity can adversely affect HRQOL in patients with bronchiectasis. One of the primary goals in the treatment of patients with bronchiectasis is to improve their symptoms. Accordingly, the treatment of bronchial hyper-responsiveness may be neglected in clinical evaluation. Protecting a sufficient HRQOL is considered one of the main objectives of health care. Future studies should investigate how these other features of bronchiectasis influence HRQOL.

This study has several limitations. First, a limited number of subjects with bronchiectasis were sampled. However, statistically significant and important values were observed in our study. Second, investigations such as the 6-min walk test and Chronic Respiratory Disease Questionnaire were not performed in this study. Third, we did not measure the responsiveness to change over time due to intervention. However, a basic requirement of responsiveness is the instrument's reproducibility (test-retest reliability as a measure of longitudinal stability), which has been shown to be excellent for the SOLQ. The validation of HRQOL instruments, such as the SOLQ, is an ongoing process, with each clinical study providing further data on SOLQ validity.

Conclusions

In summary, we found that the SOLQ had good repeatability in a subgroup of stable subjects over a short period of time and good internal consistency when applied to subjects with bronchiectasis. The data show that the SOLQ is a valid measurement tool for bronchiectasis. The SOLQ may be used for evaluation of the HRQOL of patients with bronchiectasis in daily practice. Additionally, subjects with bronchiectasis and bronchial hyper-reactivity had poorer HRQOL, lower baseline spirometric values, and more exacerbations, suggesting more severe disease. Thus, the presence of bronchial hyper-reactivity should be taken into consideration as part of the clinical evaluation of patients with bronchiectasis.

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