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Quality of Life in Children with Non-Cystic-Fibrosis Bronchiectasis

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Key Words
Non-cystic-fibrosis bronchiectasis · Children · Health-related quality of life

Abstract
Background: Non-cystic-fibrosis bronchiectasis (non-CF BE) continues to be a problem in developing countries and it is therefore important to examine and assess this disease. ***Objectives:*** The aims of this prospective study were to evaluate the health-related quality of life (HRQOL) in non-CF BE children and also to assess the risk factors associated with HRQOL. ***Methods:*** Forty-two non-CF BE patients between the ages of 9 and 18 years were enrolled in the study. All recruited patients completed the generic Short-Form-36 (SF-36), the St. George's Respiratory Questionnaire (SGRQ) for disease-specific QOL scale and forms on socioeconomic status (SES). The extent and severity of CT abnormalities were evaluated by using the modified Bhalla scoring system. Association between HRQOL questionnaires and demographic variables, pulmonary function test, high-resolution CT scores and SES were evaluated. ***Results:*** SF-36 and SGRQ subscales all correlated inversely with each other (SF-36 physical component summary with SGRQ symptoms score: r = –0.466, p = 0.001, activity score: r = –0.666, p = 0.000 and impact score: r = –0.667, p = 0.000. SF-36 mental component summary with SGRQ symptoms score: r = –0.396, p = 0.005, activity score: r = –0.533, p = 0.000 and impact score: r = –0.512, p = 0.000). There was an inverse correlation between SGRQ symptoms scores and the duration of regular follow-up (r = –0.3, p = 0.04). The symptoms subscale of SGRQ correlated positively with low values for pulmonary function testing (r = –0.417, p = 0.003) and frequent antibiotic requirements (r = 0.303, p = 0.035). ***Conclusions:*** Early diagnosis and regular follow-up of children with non-CF BE is important for improving their QOL. As expected, the severity and frequency of symptoms are inversely related to the pulmonary function and the QOL scores. A disease-specific questionnaire should be developed to monitor QOL in children with non-CF BE.

Introduction

Bronchiectasis (BE) is characterized by irreversible dilation of the airways associated with frequent bacterial infections and inflammatory destruction of the bronchial and peribronchial tissue [1]. Although BE is commonly due to cystic fibrosis (CF) in developed countries, non-CF etiologies are also common in developing countries [1–3].

In chronic diseases, traditional measurements of the physiological status (e.g. lung function and body mass index) are inadequate to cover all aspects of the disease with respect to daily life and health-related quality of life (HRQOL). HRQOL involves assessing a patient's percep-

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tion of performance in the domains of physical function, emotional state, social interaction and somatic sensation, measured with either generic or disease-specific instruments [4, 5]. Generic instruments, like the Medical Outcomes Study Short-Form-36 (SF-36), provide summaries of HRQOL and can be used for different diseases [6, 7]. Disease-specific questionnaires focus on one condition and relevant areas of function. The St. George's Respiratory Questionnaire (SGRQ) is one of the most commonly used respiratory disease-specific HRQOL instruments, originally designed to measure the impact of chronic obstructive pulmonary disease on overall health and well-being in daily life [8–10]. Disease-specific HRQOL instruments are much preferred to general instruments since they are designed to assess symptoms and areas of functioning that are most important for a specific disease [11]. SGRQ and SF-36 are adult scales and have both been used for patients with non-CF BE [12–16]. Although they have not been validated in children, a few studies have used them for children between the ages of 6 and 12 years [17, 18]. There is no specific QOL scale for non-CF BE children.

Non-CF BE continues to be a problem in developing countries and it is important to evaluate the QOL and determine the associated factors. Kapur et al. [19] demonstrated a significant burden on the parents of children with non-CF BE. In their study, the questionnaires were completed by the parents. To our knowledge, there are no studies that have evaluated the HRQOL of children with non-CF BE where the children have completed the questionnaires on their own.

Our study aims were to evaluate HRQOL in non-CF BE children and also to assess the risk factors associated with HRQOL, such as age at diagnosis, follow-up period, pulmonary function test (PFT), high-resolution computed tomography (HRCT) score and socioeconomic status (SES). Our hypothesis was that children with non-CF BE have impaired HRQOL and we will link this to the severity of lung disease.

Methods

Study Population

Non-CF BE patients between the ages of 9 and 18 years, who had been followed up by the Marmara University Pediatric Pulmonology Outpatient Clinic were enrolled in the study from November 2011 to April 2012. In all cases, BE was diagnosed by HRCT of the chest and all had a sweat chloride level of <60 mEq/l. Repeated sweat tests and genetic analysis for CF were performed in patients with an undetermined etiology of BE. All patients were in a stable phase of their illness during the study period. All patients and parents were informed about the study; personal details and consent forms were completed by the parents. The study was approved by the Marmara University Faculty of Medicine Research Ethics Committee (No. 0.9.2011.0006).

Design

Demographic data including age at diagnosis, clinical findings, sputum culture, number of hospitalizations, the frequency of antibiotic use within a year, underlying causes and PFT values of non-CF BE patients were recorded.

Disease severity was defined according to the FEV_1 (normal FEV_1 >80%) and was divided into 3 categories: mild (FEV_1 >70%), moderate (FEV_1 41–69%) and severe disease (FEV_1 <40%) [20]. The extent and severity of HRCT abnormalities were scored by an experienced radiologist who used the modified Bhalla scoring system. Total score (range 0–31) was derived by adding the scores for each abnormality; 0 = normal, 1–10 = mild, 11–21 = moderate and 22–31 = severe [21].

Questionnaires (SF-36, SGRQ and SES) were completed by the patients during control visits.

Assessment of HRQOL

SF-36

The SF-36 is a self-administered questionnaire containing 36 items which provide 8 scales, 4 of which relate to physical health: physical functioning, role limitations attributable to physical problems, bodily pain and general health. The others are vitality, social functioning, role limitations attributable to emotional problems and mental health. Each scale is scored from 0 to 100. A score of 100 in physical functioning, role limitations attributable to physical or emotional problems, bodily pain or social functioning indicates an absence of limitations or disability. For general health, mental health and vitality, the best health corresponds to a score of 50. These 8 scales provide 2 summary scores: the physical component summary (PCS) and the mental component summary (MCS), in which a normal score is 50 ± 10. The normal value is 50 and diminishing scores indicate worsening conditions. The second version of the SF-36 was used in our study; it can be completed in only 5 min [5–7, 17].

SGRQ

The SGRQ is a specific questionnaire for patients with respiratory disorders consisting of 50 items assessed by means of 3 components: symptoms, activity and impact. The symptoms component comprises 8 items including frequency of cough, sputum production, wheeze, breathlessness and the duration and frequency of breathlessness or wheeze. The activity component (16 items) is concerned with physical activities that either cause or are limited by breathlessness. The impact component (26 items) covers a range of aspects concerning social functioning and psychological disturbances resulting from airways disease. Scores ranging from 0 to 100 are calculated for each component as well as a total score which summarizes the responses to all items. A score of zero indicates no impairment of QOL. The questionnaire can be completed in 10 min [8, 9, 17].

Assessment of SES

The SES of the patients was evaluated by a Turkish scale validated by Kalaycıoğlu et al. [22]. Parental educational and occupational status, house ownership, number of rooms at home, electrical equipment (e.g. computer, dishwasher, washing machine,

DVD, stereo and camera) at home, the value of the flat and car ownership were evaluated in this questionnaire. According to this scale, there were 5 categories of SES: low, low–medium, medium, medium–high and high.

Statistical Analysis

Statistical analysis was carried out with SPSS for Windows version 11.0. Continuous variables were described as means, standard deviations and medians and categorical variables were presented as proportions. Parameters with normal distribution were compared by means of an independent-groups (independent-samples) t test. Pearson's correlation analysis was used for quantitative data with normal distribution. Results were evaluated in a 95% confidence interval and the significance level was set at p = 0.05.

Results

Participants in the Survey

Forty-two non-CF BE patients between the ages of 9 and 18 years were enrolled in the study. The mean age was 12.7 ± 2.3 years and 52.4% were girls. The demographic and clinical characteristics of the patients are shown in table 1.

Evaluation of HRCT findings by modified Bhalla score revealed that 18 (42.9%), 22 (52.4%) and 2 (4.8%) patients had mild, moderate and severe disease, respectively.

All patients had sputum cultures and 55% had growth in their cultures. Sputum cultures were positive for *Haemophilus influenza* in 12 (28.6%), *Streptococcus pneumoniae* in 9 (21.4%) and *Staphlococcus aureus* in 2 (4.8%). The SES was medium–low in 16 (38.1%), medium in 17 (40.5%), medium–high in 5 (11.9%) and high in 4 (9.5%). Diagnosis was delayed among children with a lower SES (p = 0.01).

All of the patients were able to perform a PFT. Mean FVC and FEV_1 values were 80 ± 17.8% predicted and 79.8 ± 20.6% predicted, respectively (table 1). FEV_1 was within the normal range in 27.9% of the patients. Disease severity was mild in 39.5%, moderate in 30.3% and severe in 2.3% of the patients.

SF-36

The mean SF-36 PCS and MCS of 42 non-CF BE children were 44.4 ± 8.5 (25.8 to 59.5) and 42.9 ± 8.8 (19.2 to 59.2), respectively (normal range 50 ± 10, diminishing scores indicate worsening). There was a significant correlation between the PCS and MCS scores (r = 0.353, p = 0.01). There was also a positive correlation between SF-36 PCS score and % predicted $FEF_{25–75}$ of the patients (r = 0.378, p = 0.01). No correlation was found between SF-36 PCS and MCS scores and current age, age at diagnosis, age at the beginning of the symptoms, height and weight Z-scores, etiology of non-CF BE, sputum microbiology, HRCT score or SES.

Table 1. General characteristics of 47 patients enrolled in the study

Current age, years	12.7±2.3
Age at the start of symptoms, years	3.4±3.3
Age at diagnosis, years	7.6±3.3
Follow-up period, years	3.8±2.5
Etiology	
Idiopathic	14 (33.3)
Primary ciliary dyskinesia	11 (26.2)
Postinfectious	8 (19.1)
Primary immunodeficiency	8 (19.1)
Foreign-body aspiration	1 (2.3)
Height Z-score	–0.4±1.2
Weight Z-score	–0.5±1.1
Antibiotic frequency/year	3.5±2.5
At least 1 hospital admission/year	14 (29.8)
Modified Bhalla score	12.2±6.1
FVC, % predicted (n = 46)	80.0±17.8
FEV_1, % predicted (n = 46)	79.8±20.6
PEF, % predicted (n = 46)	75.0±21.4
$FEF_{25–75}$, % predicted (n = 46)	79.6±28.5
SF-36 PCS	44.4±8.5
SF-36 MCS	42.9±8.8
SGRQ	
Symptoms score	57.9±20.3
Activity score	44.3±23.2
Impact score	29.1±19.7
Total score	38.0±18.4

Data are presented as mean ± SD or number (%).

SGRQ

Mean SGRQ scores for symptoms, activity and impact were 57.9 ± 20.9 (20.5–100) and 44.3 ± 23.2 (0–93.3), 29.1 ± 19.7 (1.6–79.9), respectively (best possible score = 0 and worst possible score = 100). All three subscales of the SGRQ correlated significantly with each other (symptoms with activity r = 0.539, p = 0.000; symptoms with impact r = 0.407, p = 0.005; activity with impact r = 0.719, p = 0.000).

There was no correlation between SGRQ scores and current age, age at diagnosis, age at the beginning of the symptoms, height and weight Z-scores, etiology of non-CF BE, sputum microbiology, HRCT score or SES.

An inverse correlation was found between the SF-36 and SGRQ subscales (table 2). No significant association was found between the SF-36 and SGRQ scores and the HRCT scores of the patients. There was an inverse correlation between SGRQ symptoms scores and the duration of regular follow-up (r = –0.3, p = 0.04). The symptoms subscale of SGRQ positively correlated with low PFT values (r = –0.417, p = 0.003) and frequent antibiotic requirements (r = 0.303, p = 0.035) (fig. 1). Pearson's correlations are presented in table 3.

Table 2. SF-36 and SGRQ subscales had an inverse correlation

SGRQ		SF-36 PCS	SF-36 MCS
Symptoms score	r	–0.466	–0.396
	p	0.001	0.005
Activity score	r	–0.666	–0.533
	p	0.000	0.000
Impact score	r	–0.667	–0.512
	p	0.000	0.000
Total score	r	–0.705	–0.554
	p	0.000	0.000

Discussion

To our knowledge, this is the first study evaluating the HRQOL of children with non-CF BE in which the questionnaires were completed by the children. We evaluated HRQOL in non-CF BE children and also assessed the effects of clinical characteristics and SES from generic (SF-36) and disease-specific (SGRQ) QOL questionnaires. The SGRQ symptoms score was better in patients with longer, regular follow-up periods, and patients with low PFT values had worse symptoms scores. Patients with a low SES were diagnosed later than those with a higher SES.

One important limitation of this study was that the SGRQ and SF-36 questionnaires have not been validated in children. They have been previously used for children (6–12 years of age), however [17, 18].

Although several QOL scales have been developed for chronic respiratory diseases (asthma, COPD and cystic fibrosis), there is no specific QOL scale for non-CF BE [12]. Generic and specific (CF or adult chronic lung disease) scales have been used to determine the QOL with non-CF BE adult patients. Studies have shown that HRQOL has been adversely affected in adults with non-CF BE [9, 12–16]. The SGRQ is the only scale that measures disease-specific QOL in adult patients which has been used in a few studies in non-CF BE [9, 12–14]. Although the SGRQ and the SF-36 have been used for children (6–12 years) previously, they were not actually validated [17, 18]. They are both complex and we consider them to be valid if completed by children without the help of their parents [23]. In this study, all of the children completed the questionnaires on their own.

There is only 1 study evaluating the HRQOL of non-CF BE children in which the DASS (Depression, Anxiety

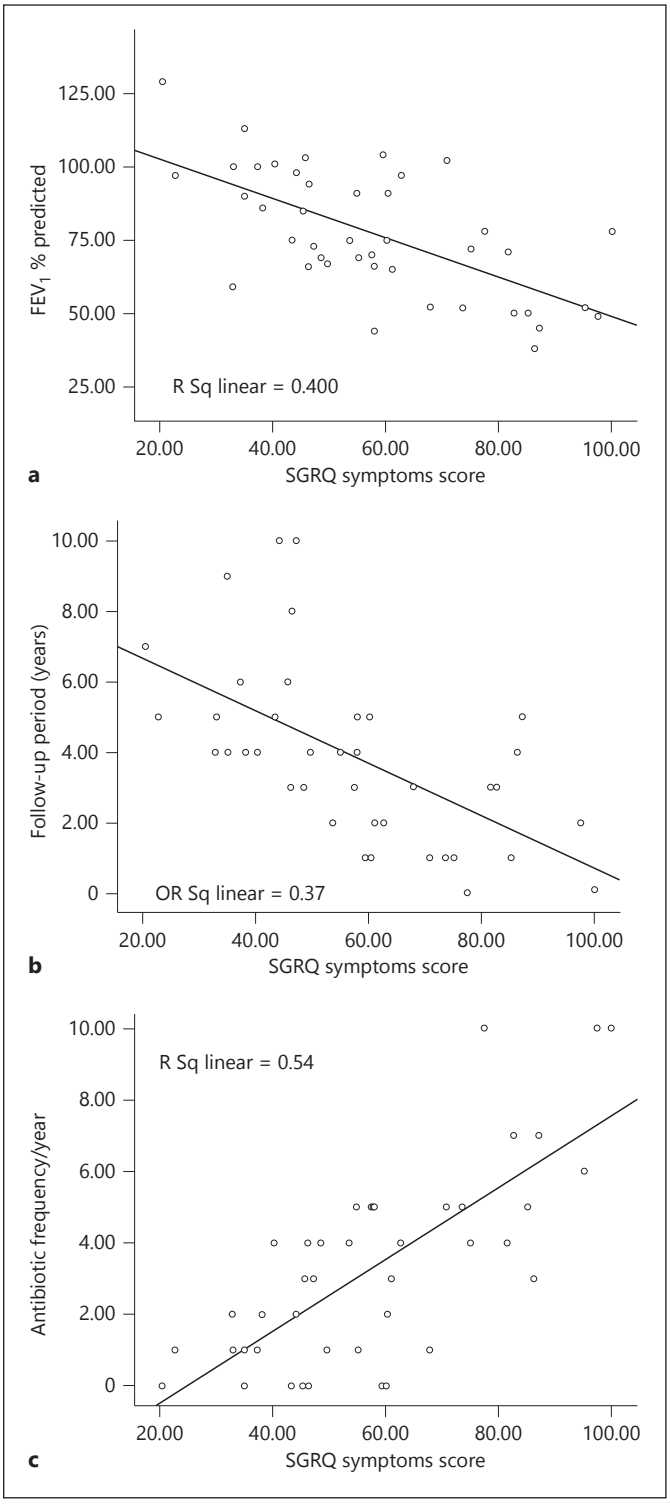

Fig. 1. Correlation of SGRQ symptoms score with FEV_1, follow-up period and antibiotic frequency. **a** SGRQ symptoms score correlates with FEV_1 (r = –0.417, p = 0.003). **b** SGRQ symptoms score correlates with regular follow-up (r = 0.3, p = 0.04). **c** SGRQ symptoms score correlates inversely with frequent antibiotic requirements (r = 0.303, p = 0.035).

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Table 3. Pearson's correlation coefficient (r) between the study variables and subscale and total scores of the QOL questionnares, the SGRQ and SF-36

Variables	SGRQ symptoms	SGRQ impact	SGRQ activity	SGRQ total	SF-36 PCS	SF-36 MCS
Current age	–0.235	0.146	–0.002	0.039	–0.075	0.195
Age at diagnosis	–0.285	0.013	–0.051	–0.086	0.041	0.108
Symptomatic age	–0.192	–0.067	–0.246	–0.150	0.058	0.101
Follow-up period	**–0.300**	–0.020	–0.160	–0.104	0.148	0.264
FVC	**–0.429**	–0.159	–0.159	–0.244	0.083	0.584
FEV_1	**–0.417**	–0.184	–0.252	–0.265	0.147	0.106
PEF	**–0.436**	–0.183	**–0.356**	**–0.307**	0.236	0.136
$FEF_{25–75}$	**–0.409**	–0.270	–0.283	**–0.311**	**0.378**	0.097
Antibiotic frequency	**0.303**	0.110	0.151	0.166	–0.375	–0.246
HRCT score	0.668	0.042	0.694	0.571	0.864	0.870
SES	0.553	0.372	0.843	0.496	0.179	0.336

Bold r values: $p < 0.01$.

and Stress scale) 21-item questionnaire and the PC-QOL (parent-proxy cough-specific quality of life) questionnaire were completed by the caregivers due to the young age of the children [19]. Although pediatric data are not available, adult studies showed that *Pseudomonas aeruginosa* infection, dyspnea, sputum production and frequency of exacerbations are the factors that have an impact on HRQOL in patients with non-CF BE [9, 12, 24]. McManus et al. [23] demonstrated the relationship between the symptoms scores and age in adult patients; a quick deterioration of physical and symptoms scores was reported after the age of 25 years. Pifferi et al. [17] reported symptom, activity and mental impairment in patients with late-diagnosed primary ciliary dyskinesia. There was no significant relationship between current age, age at diagnosis, age at onset of symptoms and QOL scores in our study.

McManus et al. [23] found that patients with a longer follow-up period had better impact scores. Inversely, in patients with primary ciliary dyskinesia, Pifferi et al. [17] reported that patients with longer follow-up periods had worse SGRQ symptoms and impact scores, thought to be related to decreased adherence to the treatment and ignorance of the benefits. In our study, a negative significant correlation was found between the follow-up duration and SGRQ symptoms scores. Patients attending the clinic regularly had better HRQOL scores.

Some adult studies show an inverse relationship between FEV_1, CT scores and SGRQ scores [12, 25, 26]. Eshed et al. [27] did not find a correlation between CT scores and PFT in adult patients, but found a positive correlation between HRCT scores and SGRQ scores.

We also found that high PFTs were associated with better HRQOL scores. However, CT scores were not significantly correlated with HRQOL scores, suggesting that functional status is more important in QOL measures.

Generic and disease-specific QOL questionnaire scores are worse in patients with more frequent exacerbations that require antibiotic treatment [22, 24]. Similarly, in our study, the patients on antibiotics more frequently had worse SF-36 physical scores and SGRQ symptoms scores.

Non-CF BE is more frequent in children with a low SES in Australia and New Zealand [28, 29]. Ozdemir et al. [30] reported that adult patients with a low SES had higher rates of BE. Although their symptoms began at an early age, patients with a low SES were only diagnosed later. In our study, patients with a low SES were also diagnosed later than the patients with a higher SES.

In conclusion, early diagnosis and regular follow-up of children with non-CF BE is important for improving their QOL. As expected, the severity and frequency of symptoms are inversely related to pulmonary function and the QOL scores. Disease-specific questionnaires should be developed to monitor QOL in children with non-CF BE.

Disclosure Statement

None of the authors has a financial or proprietary interest in any method or material mentioned in the text.

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