Predictors of Impaired Survival in Subjects With Long-Term Oxygen Therapy

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BACKGROUND: The need for long-term oxygen therapy (LTOT) is usually a sign of advanced disease, which could trigger advance care planning. However, LTOT is used in patients with different characteristics and multiple diagnoses beyond COPD. We studied the factors associated with survival in an unselected sample of subjects who started LTOT. METHODS: We conducted a retrospective study that included 195 subjects for whom LTOT was initiated in Tampere University Hospital from January 1, 2012, to December 31, 2015, and followed up until December 31, 2017. RESULTS: The most frequent diseases that caused the need for LTOT were COPD and interstitial lung diseases. Most of the subjects (69%) died during the study period; the median survival time was 2.2 y. The subjects with interstitial lung disease as a primary disease for LTOT had a shorter survival time (median 0.9 y) compared with those with COPD (median 2.4 y, $P < .001$). Survival was shorter in the subjects ages >75 y (median 1.4 y) compared with those who were ages ≤75 y (median 2.8 y, $P = .001$) and also in those who required help with daily activities (median 1.2 y) compared with those who did not (median 3.3 y, $P < .001$). In multivariate analysis, a diagnosis of interstitial lung disease (hazard ratio 2.1, 95% CI 1.4–3.2), Charlson comorbidity index (hazard ratio 1.26, 95% CI 1.11–1.43), and required help in activities of daily living (hazard ratio 2.1, 95% CI 1.4–3.1) were associated with impaired survival. CONCLUSIONS: The survival of the subjects who started LTOT varied greatly. The subjects with interstitial lung disease and those who required assistance with activities of daily living were at risk of dying in ~1 y, which suggested that advance care planning should be directed especially to these patients. *Key words: chronic hypoxemia; long-term oxygen therapy; interstitial lung disease; chronic obstructive pulmonary disease; activities of daily living; survival.* [Respir Care 2019;64(11):1401–1409. © 2019 Daedalus Enterprises]

Introduction

Chronic hypoxemia is a common feature in many end-stage respiratory diseases. Long-term oxygen therapy

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(LTOT) can be used to treat hypoxemia, but the effects of LTOT on survival and precise indications for it have been assessed only in subjects with COPD. LTOT prolongs survival and is recommended in patients with COPD who have severe hypoxemia, defined as $P_{aO_2} \leq 55$ mm Hg or P_{aO_2} between 55 and 60 mm Hg in the presence of complicating factors, such as peripheral edema, polycythemia (hematocrit ≥ 55%) or pulmonary hypertension.[1-3] There

is clear evidence for LTOT usage in patients with COPD and with these criteria, but LTOT does not seem to improve survival in patients with COPD and with moderate hypoxemia only.[4-7]

Although the best evidence for the use of LTOT is based on studies in subjects with COPD, LTOT is also recommended in many other diseases that cause hypoxemia (interstitial lung disease, cystic fibrosis, pulmonary hypertension, and cardiac failure) even though there is no clear evidence of its effectiveness on survival or alleviation of symptoms.[3] In many diseases, chronic respiratory insufficiency and hypoxemia develop at the late stages of the disease, when the life expectancy of the patient is limited.[8-10] Therefore, the clinical decision to initiate LTOT should be concomitantly considered with timely advance care planning and palliative care consultation. However, the individual prognosis in patients who receive LTOT is difficult to estimate due to considerable variation in the rate of progression among different pulmonary diseases and to the effects of other factors, such as age and comorbidities. At the moment, there is little information regarding which factors among patients on LTOT are associated with their prognosis in clinical practice. Our aim was to study the factors associated with survival in subjects for whom LTOT was initiated in a real-life setting.

Methods

Patients

All the patients who were started on LTOT in the respiratory insufficiency unit of the Tampere University Hospital from January 1, 2012, to December 31, 2015, were included in this study. The subjects were followed up until death or December 31, 2017.

Data Collection

All medical records, including notes of the nurses, were reviewed. The collected characteristics of the subjects included age, sex, weight, height, living conditions, working status, smoking status, medication, diagnoses, and date of death. Results of spirometry, arterial blood gases, and nocturnal or daytime oxygen saturation were recorded as well. According to the comorbidities, the Charlson comorbidity index was calculated for each subject based on the disease severity.[11,12] For subjects with COPD, the Global Initiative for Chronic Obstructive Lung Disease stages for the severity of the air-flow limitation were defined.[13] The subjects were considered to require assistance in activities of daily living (ADL) if they needed continuous help from a family member who worked as a caregiver, received home care services (eg, dietary services, ablution, dressing, or medication), or permanently stayed in a nursing home or

community hospital. The disease that caused the need for initiation of LTOT was defined as the primary disease, whereas all other diseases were considered comorbidities.

Statistical Analysis

Based on a visual estimation, many of the distributions were non-normal, and nonparametric tests were used. A comparison of different groups was performed by using the Mann-Whitney Test for continuous variables and the Pearson chi-square test or Fisher exact test for categorical variables. The Kaplan-Meier method and the Cox proportional hazard regression analysis were used for survival estimation. Statistical significance was set as $P < .05$. Analyses were performed with IBM SPSS Statistics version 22.0 (Armonk, NY).

Ethical Consideration

This study was approved by the regional ethics committee of Tampere University Hospital, Finland (approval R15180/1.12.2015).

Results

Altogether 195 subjects started LTOT during the study period and were included. Characteristics of the subjects are shown in Table 1. Most subjects (68%) smoked before the start of LTOT, and the median pack-years among smokers was 40 (interquartile range [IQR] 20–50). Almost two

> **QUICK LOOK**
>
> **Current knowledge**
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> Long-term oxygen therapy (LTOT) prolongs survival in patients with COPD and severe hypoxemia. It is also used in several other diseases that cause hypoxemia, although there is no clear evidence of its effectiveness. The need for LTOT is considered a marker of advanced disease, but there is no current knowledge about which factors are associated with poor survival among these patients in a real-life setting.
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> **What this paper contributes to our knowledge**
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> The overall survival of subjects with LTOT was poor but varied greatly. The subjects who had interstitial lung disease as the primary disease that caused the need for LTOT or needed help in activities of daily living were more likely to die during the first year after the onset of LTOT. The Charlson comorbidity index was associated with worse overall survival as well.

Table 1. Subject Characteristics

Characteristic	Value
Sex, *n* (%)	
Males	121 (62.1)
Females	74 (37.9)
Age	
Median (IQR) y	74.0 (67.0–81.0)
≤75 y, *n* (%)	113 (57.9)
>75 y, *n* (%)	82 (42.1)
Body mass index, median (IQR) kg/m^2*	27.7 (23.1–33.2)
Need for help with ADL, *n* (%)	
No	105 (53.8)
Yes	90 (46.2)
Smoking status, *n* (%)	
Never-smoker	60 (30.8)
Ex-smoker	133 (68.2)
Smoker	1 (0.5)
Unknown	1 (0.5)
FEV$_1$†	
Median (IQR) L	1.30 (0.96–1.82)
Median (IQR) % of predicted	51.0 (36.5–64.5)
FVC‡	
Median (IQR) L	2.49 (1.86–3.06)
Median (IQR) % of predicted	72.0 (57.0–84.0)
P$_{aO_2}$ with room air, median (IQR) mm Hg§	51.7 (47.3–55.5)
Oxygen flow, median (IQR) L/min	1.5 (1.0–2.0)
Primary disease that caused the need for LTOT, *n* (%)	
COPD	92 (47.2)
Interstitial lung diseases	44 (22.6)
Heart diseases	18 (9.2)
Obesity-hypoventilation syndrome	18 (9.2)
Other	23 (11.8)
Comorbidities, *n* (%)	
Hypertension	120 (61.5)
Heart diseases	112 (57.4)
Cerebrovascular diseases	13 (6.7)
Diabetes	60 (30.8)
COPD	18 (9.2)
Asthma	27 (13.8)
Sleep apnea	38 (19.5)
Neurologic diseases	33 (16.9)
Renal diseases	18 (9.2)
Rheumatic diseases	18 (9.2)
Cancer	38 (19.5)
Others	49 (25.1)
No comorbidities	9 (4.6)
Charlson comorbidity index, median (IQR)	2.0 (1.0–3.0)

* Data were missing in 3 subjects: confined to bed i.e. unable to perform measurements because of tetraplegia or muscle dystrophy.
† Data were missing in 18 subjects: lack of co-operation i.e. subject didn't understand instructions because of Alzhemer disease or schizophrenia etc. (9), acute illness i.e. respiratory infections and pulmonary embolisms. (8), data not available (1).
‡ Data were missing in 29 subjects: only microspirometry available (11), data same as stated in part † (18).
§ Data were missing in 42 subjects: P$_{aO_2}$ < 60 mm Hg or saturation < 92% with supplemental oxygen (31), nocturnal or exertional desaturation (8), other reasons (3).
IQR = interquartile range
ADL = activities of daily living
LTOT = long-term oxygen therapy

thirds of subjects on LTOT were men. Of the subjects with COPD, 3.3, 27.2, 43.5, and 26.1% belonged to Global Initiative for Chronic Obstructive Lung Disease stages 1, 2, 3 and 4, respectively. Interstitial lung disease and COPD were the most-common diseases that cause the need for LTOT. Of the subjects with interstitial lung disease, 58% had idiopathic pulmonary fibrosis (IPF). Eighteen subjects had obesity-hypoventilation syndrome, and 16 of these (89%) used CPAP or noninvasive ventilation, together with LTOT, whereas the remaining 2 subjects only received LTOT due to nonadherence with CPAP or noninvasive ventilation. All the subjects had an oxygen concentrator, and 60 of them (30.8%) also had ambulatory oxygen therapy. Overall, the subjects had a median of 3 comorbidities, and cardiovascular diseases were the most common. Continuous help at home was needed by 68 of the subjects (35%), whereas 22 (11%) permanently stayed in a nursing home or a community hospital.

Survival

During the study period, 133 subjects (69%) died, and the median (IQR) survival time of the total study sample was 2.2 (0.8–4.4) y. The subjects with interstitial lung disease as the primary disease had a shorter survival time (median [IQR] 0.9 [0.4–2.2] y) compared with subjects with COPD (median [IQR] 2.4 [1.1–4.5] y, *P* <.001). In addition, age > 75 y and the need for help with ADL were associated with shorter survival (Fig. 1). Among the subjects with COPD Global Initiative for Chronic Obstructive Lung Disease stages were not significantly associated with survival (*P* = .77) Fifty-six subjects (29%) died during the first year after the initiation of LTOT. The characteristics of the subjects who died in, or survived, over the first year are shown in Table 2. Those who died during the first year were older, needed help more often with ADL, and had lower body mass index (BMI). The 1-y survival rate was lower in the subjects with interstitial lung disease (47%) compared with those with COPD (79%) (*P* < .001) as the primary disease. None of the subjects with obesity-hypoventilation syndrome as their primary disease died in the first year.

Factors Associated With Overall Survival

The factors associated with subjects' survival time are presented in Table 3. In univariate analysis, older age, the need for help in ADL, lower BMI, interstitial lung disease, the Charlson comorbidity index, and heart (coronary artery disease or heart failure) or neurologic diseases as comorbidities were associated with shorter survival. In contrast, sleep apnea as a comorbidity was associated with longer survival. In multivariate analysis, the need for help with ADL. Charlson comorbidity index, and interstitial lung
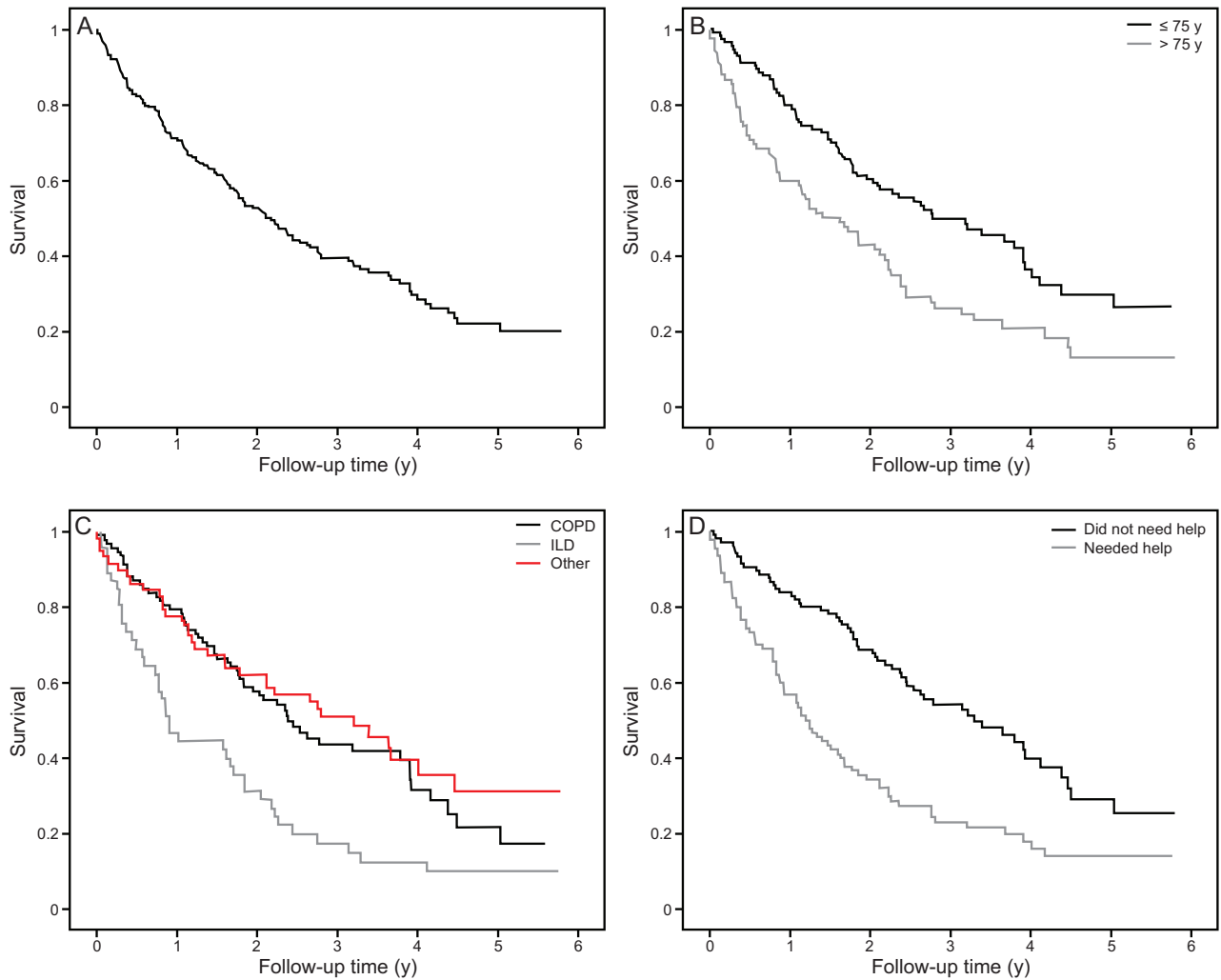
Fig. 1. A: Overall survival after the initiation of long-term oxygen therapy in the total study sample. B: In subjects ages >75 y (median 1.4 [IQR 0.4–3.1] y) and ≤75 y (median 2.8 [IQR 1.1–NA] y), $P = .001$. C: According to primary disease, COPD (median 2.4 [IQR 1.1–4.5] y), ILD (median 0.9 [IQR 0.4–2.2] y), or other (median 3.2 [IQR 1.1–5.8] y), $P < .001$ between COPD and ILD. D: According to the need for help in activities of daily living, did not need help (median 3.3 [IQR 1.7–5.8] y) and needed help (median 1.2 [QR 0.4–2.8] y), $P < .001$. IQR = interquartile range; ILD = interstitial lung disease, NA = not available.

disease as the underlying need for LTOT remained independently associated with shorter survival (Table 3).

Discussion

We presented a real-life study in an unselected sample of subjects for whom LTOT was prescribed and initiated. The median survival of the total sample was ~2 y, but this varied significantly among different subject groups. The subjects with interstitial lung disease had significantly shorter survival than did those with COPD, and more than half of the subjects with interstitial lung disease died during the first year after initiation of LTOT. The need for help in ADL, a higher Charlson comorbidity index, and interstitial lung disease as a primary disease that necessi-

tated LTOT were independently associated with poorer survival.

The subjects on LTOT who needed constant help with ADL had worse overall and 1-y survival compared with those who managed by themselves or needed only occasional help. It seemed that the limited general performance status better reflected the risk of death than did lung function or blood gas levels in a nonselected subject sample with LTOT. To our knowledge, this was the first study to show the association between the need for help in ADL and survival among subjects with LTOT, although the need for help in ADL is associated with worse survival among subjects with interstitial lung disease or COPD in general.[14,15] Leuchte et al[14] showed that subjects with IPF (with or without LTOT) who

Table 2. Subject Characteristics According to 1 Year Survival After the Initiation of LTOT

Characteristic	Died during the 1st Year	Survived Over 1 Year	P*
Total, *n*	56	139	
Sex, *n* (%)			.17
Males	39 (69.6)	82 (59.0)	
Females	17 (30.4)	57 (41.0)	
Age			
Median (IQR) y	78.5 (68.0–85.0)	72.0 (66.0–79.0)	.004
≤75 y, *n* (%)	23 (41.1)	90 (64.7)	.002
>75 y, *n* (%)	33 (58.9)	49 (35.3)	
Body mass index, median (IQR) kg/m²	25.5 (22.9–29.9)	28.6 (23.2–33.9)	.03
Need for help with ADL, *n* (%)			<.001
No	17 (30.4)	88 (63.3)	
Yes	39 (69.6)	51 (36.7)	
Smoking status, *n* (%)			.61
Never-smoker	21 (37.5)	39 (28.1)	
Ex-smoker	35 (62.5)	98 (70.5)	
Smoker	0 (0.0)	1 (0.7)	
Not known	0 (0.0)	1 (0.7)	
FEV$_1$			
Median (IQR) L	1.47 (1.04–1.95)	1.28 (0.91–1.79)	.10
Median (IQR) % of predicted	57.0 (40.0–66.0)	47.0 (35.0–63.0)	.039
FVC			
Median (IQR) L	2.32 (1.91–3.00)	2.56 (1.82–3.09)	.58
Median (IQR) % of predicted	70.0 (55.8–86.3)	72.5 (57.3–83.8)	.77
P$_{aO_2}$ with room air, median (IQR) mm Hg	54 (46.5–58.5)	57.4 (48.0–54.8)	.25
Oxygen flow, median (IQR) L/min	2.0 (1.0–2.0)	1.5 (1.0–2.0)	.54
Primary disease that caused the need for LTOT, *n* (%)			<.001
COPD	19 (33.9)	73 (52.5)	.02
Interstitial lung disease	24 (42.9)	20 (14.4)	<.001
Heart diseases	8 (14.3)	10 (7.2)	.12
Obesity-hypoventilation syndrome	0 (0.0)	18 (12.9)	.005
Other	5 (8.9)	18 (12.9)	.43
Comorbidities, *n* (%)			
Hypertension	34 (60.7)	86 (61.9)	.88
Heart diseases	35 (62.5)	77 (55.4)	.36
Cerebrovascular diseases	4 (7.1)	9 (6.5)	>.99
Diabetes	18 (32.1)	42 (30.2)	.79
COPD	7 (12.5)	11 (7.9)	.32
Asthma	4 (7.1)	23 (16.5)	.09
Sleep apnea	9 (16.1)	29 (20.9)	.45
Neurologic diseases	10 (17.9)	23 (16.5)	.83
Renal diseases	7 (12.5)	11 (7.9)	.32
Rheumatic diseases	5 (8.9)	13 (9.4)	.93
Cancer	11 (19.6)	27 (19.4)	.97
Others	13 (23.2)	36 (25.9)	.70
No comorbidities	2 (3.6)	7 (5.0)	>.99
Charlson comorbidity index, median (IQR)	2.0 (1.0–3.0)	2.0 (1.0–2.0)	.09

LTOT = long-term oxygen therapy
IQR = interquartile range
ADL = activities of daily living

needed help in ADL had worse survival compared to those who didn't need help in ADL.

Similarly, in the subjects with COPD (no mention of the possible use of LTOT), difficulties in ADL were associated with worse survival in a study by Liu et al.[15] The need for help in ADL probably reflected poor performance status and high morbidity, which are features of poor prognosis in many diseases.[16] In the current study, 83.3% of

Table 3. Factors Associated With Survival in Cox Regression Analysis

Factor	Univariate Analysis		Multivariate Analysis*	
	HR (95% Cl)	P	HR (95% Cl)	P
Sex				
Females	Ref.		ND	
Males	1.02 (0.72–1.45)	.92	ND	ND
Age (continuous)	1.03 (1.01–1.05)	.001	ND	ND
Age (categorical)				
≤75 y	Ref.		Ref.	
>75 y	1.81 (1.29–2.55)	.001	1.31 (0.90–1.90)	.15
Body mass index, kg/m^2	0.97 (0.95–0.99)	.007	0.97 (0.94–1.01)	.11
Need for help in ADL				
No	Ref.		Ref.	
Yes	2.22 (1.57–3.14)	<.001	2.10 (1.44–3.06)	<.001
Smoking status				
Never-smoker	Ref.		ND	
Ex-smoker	0.98 (0.68–1.42)	.92	ND	ND
FEV$_1$				
L	1.11 (0.84–1.48)	.47	ND	ND
% of predicted	1.01 (1.00–1.02)	.09	ND	ND
FVC				
L	0.96 (0.78–1.19)	.73	ND	ND
% of predicted	1.00 (0.99–1.01)	.48	ND	ND
P$_{aO_2}$ with room air, mm Hg	7.7 (6.15–9.53)	.86	ND	ND
Oxygen flow, L/min	0.99 (0.82–1.18)	.87	ND	ND
Primary disease that caused the need for LTOT				
COPD	Ref.		Ref.	
Interstitial lung disease	2.20 (1.46–3.29)	<.001	2.08 (1.36–3.17)	.001
Heart diseases	1.25 (0.65–2.38)	.50	1.33 (0.69–2.57)	.40
Obesity-hypoventilation syndrome	0.42 (0.19–0.92)	.031	0.49 (0.20–1.24)	.13
Other	0.98 (0.57–1.73)	.98	1.08 (0.60–1.94)	.81
Comorbidities†				
Hypertension	0.93 (0.66–1.31)	.68	ND	ND
Heart diseases	1.49 (1.04–2.12)	.03	0.94 (0.63–1.39)	.75
Cerebrovascular diseases	1.66 (0.92–3.02)	.09	ND	ND
Diabetes	1.03 (0.71–1.49)	.88	ND	ND
COPD	1.11 (0.63–1.97)	.72	ND	ND
Asthma	0.73 (0.43–1.23)	.24	ND	ND
Sleep apnea	0.40 (0.23–0.70)	.001	1.54 (0.84–2.83)	.16
Neurologic diseases	1.53 (1.00–2.32)	.048	1.00 (0.63–1.56)	.98
Renal diseases	1.64 (0.99–2.73)	.057	ND	ND
Rheumatic diseases	0.66 (0.35–1.27)	.21	ND	ND
Cancer	1.07 (0.69–1.65)	.78	ND	ND
Others	1.20 (0.81–1.75)	.36	ND	ND
No comorbidities	0.98 (0.46–2.13)	.98	ND	ND
Charlson comorbidity index	1.24 (1.11–1.39)	<.001	1.26 (1.11–1.43)	<.001

* Variables significantly associated with survival ($P < .05$) in univariate analysis, and all primary diagnoses were included.
† HR in comparison with subjects without the comorbidity in question.
HR = hazard ratio
Ref. = Reference
ND = no data
ADL = activities of daily living
LTOT = long-term oxygen therapy

the patients who couldn't perform any kind of lung function measurements (spirometry nor microspirometry) and 72.4% of those who could only perform microspirometry were in need of help with ADL, which was probably associated with poor performance status and which prevented the completion of spirometry. Due to this association, our statistical analysis may not have been sensitive enough to detect the association between poor lung function and poor survival. Further, the lack of an association between baseline P_{aO_2} and survival might have been because the baseline P_{aO_2} was not necessarily related to the forthcoming progression rate of the disease or deterioration of the patient.

In addition, a relatively high proportion of our subjects (46%) who started LTOT needed help with ADL, which, to our knowledge, has not previously been clearly reported. In a study by Okubadejo et al,[17] subjects with advanced COPD and on LTOT were reported as less independent with ADL than those not on LTOT, but the actual proportion of subjects who needed help with ADL was not reported. Thus, coping with ADL should be discerned in every patient who starts LTOT as an estimation of survival and social support.

The median survival of the subjects with COPD who received LTOT was reported to be approximately 2–3 y,[8,9] whereas, in a recent study on subjects with interstitial lung disease and on LTOT, the survival was only 8.4 months.[10] Our results were well in line with these numbers, but we were able to show this difference in a single center clinical study as well. More than half of our subjects with interstitial lung disease had a diagnosis of IPF, which further explained the poor survival of this subject group because the median survival after a diagnosis of IPF is only approximately 2–4 y.[18-22] Our results highlighted the importance of a primary diagnosis in patients with LTOT as a clinical tool in estimating prognosis. Further, there is no clear evidence for the beneficial role of LTOT on survival or symptom alleviation in patients with interstitial lung disease or IPF.[23]

In the univariate analysis, FEV_1 was significantly higher in the subjects who died during the first year, but this was not significant in the multivariate analysis. This was probably explained because the subjects with interstitial lung disease had shorter survival than those with COPD, whereas COPD as an obstructive disease is associated with lower FEV_1. Our results were in line with previous studies that showed that, although the decline in lung function indices does predict worse survival in interstitial lung disease and COPD, impaired exercise capacity is more closely associated with mortality.[24,25]

Also, younger age and higher BMI in our subjects with LTOT were associated with better survival in univariate but not in multivariate analysis. We suggest that the better survival in subjects with highed BMI was partly explained by the survivors being more likely to have obesity-hypoventilation syndrome rather than a progressive lung disease as the main reason for initiation of LTOT. Unfortunately, the small number of subjects with obesity-hypoventilation syndrome prevented us from evaluating this group in detail. Most of the subjects with obesity-hypoventilation syndrome also had noninvasive ventilation or CPAP in addition to LTOT, as recommended in the guidelines.[3] However, lower BMI has been associated with poorer survival in several advanced diseases, such as COPD[5,26-28] and IPF,[29] which might also explain the association between shorter survival and lower BMI in univariate analysis.

Most of our subjects had comorbidities, of which heart and neurologic diseases were associated with shorter overall survival in univariate analysis. In previous studies, comorbidities were shown to be associated with impaired survival in COPD and interstitial lung disease.[30,31] However, other factors, such as lung function and poor performance status, have been more closely related to prognosis.[32] Similarly, the relation of any single comorbidity to mortality disappeared in the multivariate analysis of our data, which indicated that other factors were more important regarding survival. The multimorbidity index (Charlson comorbidity index), in turn, was associated with shorter survival in univariate analysis and also in multivariate analysis. We suggested that the total burden of comorbidities might be more closely related to poor survival than a single disease as a comorbidity.

Advance care planning and palliative care are recommended as integral parts of the treatment of patients with advanced cardiopulmonary diseases.[13,33] However, recent studies showed that advance care planning conversations are uncommon in patients with chronic respiratory disease.[34,35] The benefits of integrated palliative care in patients with COPD or interstitial lung disease include better control of dyspnea, fewer emergency department visits during the last year of life, and an opportunity for patients to die at home instead of in the hospital.[36,37] However, a recent study showed that subjects with interstitial lung disease and on LTOT still receive lower-quality end-of-life care compared with subjects with cancer.[15] One of the key questions in clinical practice is the suitable timing of advance care planning and integrated palliative care. The need for LTOT is usually a sign of advanced disease, but our study showed the heterogeneity of subjects on LTOT. Based on our results, the initiation of LTOT should be considered a trigger for advance care planning discussions and palliative care consultations, especially in patients with interstitial lung disease or those who continuously need help with ADL.

Strengths and Limitations

We presented data on all subjects who were started on LTOT in a single university hospital during the study period. This allowed us to compare prognostic factors in an unselected subject sample and to give practical information for physicians who are taking care of the patients with LTOT. However, the study sample was relatively small, and, therefore, statistical power may not be sufficient to detect weak associations, especially among subjects with diseases other than COPD and interstitial lung disease (eg, obesity-hypoventilation syndrome). Due to the retrospective nature of the study, we were not able to study all the possible factors that influenced the prognosis of the subjects. The need for help with ADL was defined by using strict criteria, which probably found subjects who needed major help but might have omitted those with lesser impairment in self-care. Further, our analysis included data on important factors, for example, lung function, only at baseline, and we thus were not able to study the predictive ability of changes in these variables during LTOT.

Conclusions

The median overall survival among a real-life sample of subjects started on LTOT was relatively short but with considerable variation. The most important clinical predictors of poor survival were interstitial lung disease as the underlying disease that necessitated LTOT, the need for help with ADL, and multiple comorbidites. We suggest that these factors could be used by clinicians as triggers for advance care planning and palliative care consultations.

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