Table 1. 1998年度20例のプロフィール

ID number	279-655-6	220-894-2	304-244-4	223-426-6	238-571-9	302-721-8	090-166-0	280-318-5	279-558-2	259-373-3	324-871-7	191-782-0	369-813-7	188-168-5	350-116-4	034-085-8	361-244-0	029-797-2	065-539-4	054-563-3	各平均
性別	女	男	男	男	男	男	男	男	男	男	男	男	男	男	男	男	男	女	女	女	
年齢	83	83	74	85	73	68	69	67	69	77	77	65	74	79	71	74	69	80	70	74	74.05
基礎疾患	慢性気管支炎	気管支喘息	慢性肺気腫	気管支喘息	慢性肺気腫	慢性肺気腫	気管支喘息	慢性気管支炎	慢性気管支炎	気管支喘息	慢性肺気腫	慢性肺気腫	慢性肺気腫	慢性肺気腫	慢性肺気腫	慢性肺気腫	慢性肺気腫	気管支喘息	気管支喘息	気管支喘息	
身長	143.2	150.7	162.4	158	167.2	164	164	161	166	163.5	157.6	165.4	157	162.5	160.3	158	168.7	142	145.2	156.5	
体重	48	42.7	60	59	60.8	58.6	49	60	66	63	46.3	61.3	43.5	49	56.3	55	54.3	32.5	52	35	
BMI	23.40750913	18.80188406	22.74988473	23.63403301	21.74858634	21.78762641	18.21832243	23.14725512	23.95122659	23.56703981	18.64097245	22.40729666	17.64777476	18.55621302	21.90994817	22.03172568	19.07961752	16.11783376	24.66437478	14.29023467	20.81796796
VC	2400	2900	3000	2320	2400	3880	3800	3180	3150	2930	2890	3450	2660	2750	3150	2330	2900	1250	2000	1450	2739.5
%VC	126.3	105	94.6	81.1	73.8	117.9	116.2	98.1	95.4	94.2	96.3	102.3	86.6	89.2	110.7	75.4	86.3	63.1	93.8	63	93.465
FEV1.0	1380	1490	1200	1100	810	1270	2220	2260	1930	1470	1650	1610	1110	2650	1910	2280	1110	800	1100	800	1507.5
%FEV1.0	79.2	81.4	55.4	59.1	34.7	52	91.3	93.3	79	68	78.9	63.1	41.7	42.1	60.6	52.1	73.2	62	68.8	55	61.545
FEV1.0%	60.7	51.7	40.4	47.4	33.8	32.7	62	71.2	61.2	53.8	57.4	48.9	42.5	30.8	54.7	36.8	38.2	65.8	56.8	45.2	49.6
SaO2	96	96	92	96	92	95	96	95	97	96	95	94	94	90	97	97	98	98	97	97	95.4
Hb	13	13.3	14.7	14.5	15.8	13.5	13.6	13.9	15	14.1	14.3	16.2	13.1	14.2	13.5	13.6	14.5	8.3	12.1	14.1	13.765
Alb	4.3	3.6	4	4.1	4.1	4.5	4.3	4.5	4.3	4.1	3.7	4.3	4.3	4.3	4.2	4.4	4.3	2.43	4.2	3.7	4.0815
H-J	3	1	3	2	3	3	3	3	3	3	3	3	2	2	0	0	1	1	1	1	2.05
PS	1	1	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	1	0	1	0.7
モラール	8	11	7	9	4	3	7	11	11	9	11	7	9	8	7	7	11	6	5	7	7.9
身体の調子	55	53	62	100	46	42	80	85	75	80	92	0	64	35	74	34	55	4	53	38	56.35
気分	85	85	66	100	46	30	87	82	78	87	86	52	67	92	81	77	59	7	51	70	69.4
呼吸困難	100	100	63	100	43	24	49	79	75	49	76	43	51	12	83	40	56	5	56	52	57.8
社会参加	13	100	51	100	33	8	51	53	83	51	32	2	53	7	32	53	59	5	9	57	42.6
家庭仕事	53	0	73	100	40	35	91	81	85	91	83	31	61	32	43	56	59	5	56	53	56.4
頭痛	100	100	82	100	46	100	100	84	98	100	93	100	54	97	85	93	100	82	7	92	85.65
食欲	63	100	90	100	41	64	75	56	95	75	73	51	58	90	81	86	100	7	69	39	70.65
不安	60	100	89	100	57	85	81	84	75	81	91	100	56	92	67	81	100	52	70	68	79.45
VASの平均	66.125	79.75	72	100	44	48.5	76.75	75.5	83	76.75	78.25	47.375	58	57.125	68.25	65	73.5	20.875	46.375	58.625	64.7875

Ｔａｂｌｅ２．１９９９年度の２０例のプロフィール

ID number	279-655-6	220-894-2	304-244-4	223-426-6	238-571-9	302-721-8	090-166-0	280-318-5	279-558-2	259-373-3	324-871-7	191-782-0	369-813-7	188-168-5	350-116-4	034-085-8	361-244-0	029-797-2	065-539-4	054-563-3	
性別	女	男	男	男	男	男	男	男	男	男	男	男	男	男	男	男	男	女	女	女	各平均
年齢	84	84	75	88	75	69	70	68	70	78	78	66	75	81	72	75	71	82	72	75	75.4
基礎疾患	慢性気管支炎	気管支喘息	慢性肺気腫	気管支喘息	慢性肺気腫	慢性肺気腫	気管支喘息	慢性気管支炎	慢性気管支炎	気管支喘息	慢性肺気腫	慢性肺気腫	慢性肺気腫	慢性肺気腫	慢性肺気腫	慢性肺気腫	慢性肺気腫	気管支喘息	気管支喘息	気管支喘息	
身長	143.2	149.5	162	157.2	167.2	164	164	161	165.5	163	158	165	157	162.5	160.3	158	168.7	142.7	145.2	157	158.55
体重	49	42.8	58.5	64	62.4	55.5	50	64.5	66.4	61	46	60	43	48	56.3	55.4	54.3	33	52.5	35	52.88
BMI	23.89516557	19.14967394	22.29080933	25.89851666	22.32091756	20.63503867	18.59012493	24.88329926	24.24220297	22.95908766	18.42653421	22.03856749	17.44492677	18.17751479	21.90994817	22.19195642	19.07961752	16.20563278	24.90153223	14.199359	20.9720213
VC	1900	2380	2740	2140	1670	3510	3220	2850	2010	3020	2720	3770	2660	3070	3490	2530	2900	1290	2010	1500	2569
%VC	126	87.5	87.5	75	51.3	107.6	99	88.5	91.7	98	91	112.8	86.6	101.3	110.7	82.6	86.3	65.4	93.9	64.5	90.36
FEV1.0	1380	1270	1180	770	680	960	1630	2310	1790	1520	1610	3400	1110	790	1910	820	1110	830	1150	810	1253.5
%FEV1.0	82.6	70.9	52.9	54.5	29.1	39.8	68.4	89	74.5	71.3	78	55.7	54.1	38.3	83	37.6	44.7	56.4	68.8	45.3	59.745
FEV1.0%	60.7	58.2	43.3	37.9	41.9	31.1	56.4	78	59.4	53.5	59	43.2	42.5	25.7	54.7	37.5	38.2	65.8	57.2	55	49.96
SaO2	97	98	92	92	93	95	96	94	95	94	94	94	96	92	97	97	96	95	97	97	95.05
Hb	12.3	12.7	15.3		15.9	13.5	14.4	13.1	15.2	14	14.2	16.8	13.6	14.1	14.7	14.8	15.4	13	13.8	12.6	14.07368421
Alb	4.1	3.5	4.1		4.1	4.4	4.3	4.1	4.6	4	3.7	4.4	4.3	32.8	4.2	4.8	4.3	3.7	4.1	4.1	5.663157895
H-J	2	2	2	2	4	3	3	3	2	3	3	3	1	2	0	0	2	1	1	0	1.95
PS	0	1	0	1	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0.45
モラール	7	10	8	8	7	4	9	7	11	7	10	10	8	8	8	7	11	0	3	9	7.6
身体の調子	58	92	52	100	30	32	32	52	83	51	77	51	56	68	32	71	87	25	56	55	58
気分	57	93	52	100	36	31	57	57	76	88	83	76	75	95	59	74	89	21	75	67	68.05
呼吸困難	100	95	10	94	25	57	28	72	100	36	44	65	45	60	95	93	76	12	45	72	61.2
社会参加	24	5	42	100	18	30	67	62	92	51	16	10	27	5	35	90	81	0	27	23	40.25
家庭仕事	41	8	82	100	86	7	57	87	73	80	84	87	14	95	54	71	80	0	14	84	60.2
頭痛	100	96	90	100	90	97	57	88	100	95	95	100	96	100	95	91	85	10	96	84	88.25
食欲	84	96	84	100	75	61	55	62	95	60	70	83	70	100	72	96	100	7	70	48	74.4
不安	53	97	52	100	92	56	54	64	100	84	80	87	90	100	72	86	100	7	90	57	76.05
VASの平均	64.625	72.75	58	99.25	56.5	46.375	50.875	68	89.875	68.125	68.625	69.875	59.125	77.875	64.25	84	87.25	10.25	59.125	61.25	65.8

Ｔａｂｌｅ３．条件逸脱例の１９９８年の状況

ID number	065-114-7	107-308-1	211-530-4	
性別	女	女	男	
年齢	85	70	78	77.66667
基礎疾患	慢性肺気腫	慢性肺気腫	気管支喘息	
身長	137.1	142	160	146.3667
体重	33.5	41.5	58.5	44.5
BMI	17.822552	20.58123	22.85156	20.41845
VC	1690	1810	2050	1850
%VC	93.3	86.1	66.6	82
FEV1.0	610	610	1800	1006.667
%FEV1.0	46.5	36.9	58.4	47.26667
FEV1.0%	36	33.7	36.7	35.46667
Hb	12.1	12.4	14.1	12.86667
Alb	3.5	4.6	3.8	3.966667
H-J	5	3	2	3.333333
PS	3	1	1	1.666667
モラール	11	11	11	11
身体の調子	42	29	90	53.66667
気分	52	30	93	58.33333
呼吸困難	23	26	92	47
社会参加	0	14	91	35
家庭仕事	5	29	93	42.33333
頭痛	97	6	93	65.33333
食欲	55	37	95	62.33333
不安	96	30	95	73.66667
VASの平均	46.25	25.125	92.75	54.70833

Ｔａｂｌｅ４．　１９９９年の追跡条件逸脱例の状況

ID　number	065-114-7	107-308-1	211-530-4	平均
性別	女	女	男	
年齢	86	71	78	78.33333
基礎疾患	慢性肺気腫	慢性肺気腫	気管支喘息	
身長	133	140	160.7	144.5667
体重	34.8	40	58.3	44.36667
BMI	19.673243	20.408163	22.57547	20.88563
VC	1170	1780	2290	1746.667
%VC	67.2	86	75	76.06667
FEV1.0	480	570	870	640
%FEV1.0	38.4	35	40.8	38.06667
FEV1.0%	47	36.5	37.9	40.46667
SaO2	96	87	97	93.33333
Hb	13.5	11.1	14.1	12.9
Alb	3.3	3	3.8	3.366667
H-J	5	4	2	3.666667
PS	3	2	0	1.666667
モラール	5	2	8	5
身体の調子	15	42	70	42.33333
気分	24	34	78	45.33333
呼吸困難	40	37	100	59
社会参加	5	6	60	23.66667
家庭仕事	8	65	10	27.66667
頭痛	96	62	100	86
食欲	5	59	71	45
不安	98	11	64	57.66667
VASの平均	36.375	39.5	69.125	48.33333

Factors that Determine the Outcome in Elderly COPD Patients Receiving Long-term Domiciliary Oxygen Therapy

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Objectives : The objective of the present study is to identify factors that determine outcome in elderly patients receiving long term oxygen therapy (LTOT) for chronic obstructive pulmonary disease (COPD).

Methods : Univariate and multivariate analysis by Cox's proportional hazards ratio model and Kaplan-Meiers survival estimates were used to quantify the relationship among a total of 34 baseline variables and overall mortality.

Patients: One hundred fifty-seven COPD patients (121 male, 36 female) receiving LTOT were registered from 1983 to 1994.

Results : By December 31, 1995, 96 patients (61.2%) had died and 13 (8.3%) were unavailable for follow up. The mean age of the patients was 79.2 yr and the mean duration of LTOT was 2.81 yr. The mean FEV1 was 0.80 ℓ and mean FEV1/FVC was 48%. The overall survival was poor and 5 yr survival was 21.6% (median survival : 3.01 yr). Among the variables tested, factors associated with poor outcome, as determined by univariate analysis, were as follows : %IBW $\leqq$85 (HR=2.15, $p<0.001$), serum albumin (g/dl) $\leqq$3.5 (1.81, $p<0.01$), hemoglobin 11.0$\leqq$(g/dl) (1.86, $p<0.01$), FEV1/FVC% > 50 (1.58, $p<0.05$), and high dyspnea ranking (grade 4 or 5) (1.74, $p<0.05$). The coexistence of bronchiectasis (3.96, $p<0.01$) and malignancy (1.85, $p<0.01$) were also contributory factors. Multivariate analysis showed independent prognostic factors influencing outcome to include nutritional status (%IBW) (HR=2.08, $p<0.01$), dyspnea ranking (2.04, $p<0.01$), coexistence of malignancy (2.02, $p<0.01$), and FEV1/FVC% (0.52, $p<0.01$).

Conclusions : We conclude that outcome in elderly COPD patients, even in those receiving LTOT, is poor, and that outcome is independently influenced

by three major factors, i.e., malnutrition, severity of dyspnea, and the coexistence of malignancy.

キーワード：Elderly COPD, long-term domiciliary oxygen therapy, prognostic factors, nutritional status, dyspnea ranking.

Introduction

In Japan, the number of patients receiving long-term domiciliary oxygen therapy (LTOT) has been increasing ever since medical insurance began accepting reimbursement in 1985; in 1994, the total number of patients receiving LTOT was estimated to be approximately 70,000.

The benefits of LTOT for hypoxic patients with chronic obstructive pulmonary disease (COPD) were established by two multicentric trials conducted by the Medical Research Council Working Party in England [1] and the Nocturnal Oxygen Therapy Trial Group in the United States [2]. It has been pointed out that COPD patients in Japan tend to be older than those in North America, where the peak prevalence is reported to be in the sixth decade [3]. Recent reports by the Respiratory Failure Research Group in Japan indicate that the prevalence of LTOT is the highest in patients in their seventh decade (39%), and there is a trend toward a gradual increase in the percentage of patients in their eighth decade receiving LTOT [4]. Questions arise as to whether the effect of LTOT in elderly patients differs from that in younger patients with respect to improvement of various medical factors, survival period, and quality of life, especially since elderly patients frequently show deterioration in their activity of daily living or may be frail. Thus, the rationale for LTOT in elderly patients who have reached the mean life span is uncertain. We hypothesize that factors that determine outcome in elderly patients with COPD receiving LTOT might differ from those in younger patients. In order to clarify this point, we attempted to determine a prognosis and identify factors that determine outcome in elderly patients receiving LTOT for COPD.

Materials and Methods

From 1983 to 1994, a total of 418 patients over 65 years of age were prescribed LTOT at the Pulmonary Division of the Tokyo Metropolitan Geriatric Hospital (TMGH), Tokyo, Japan, a main referral center. To be eligible, patients had to (1) be over 65 years of age, (2) be followed in the outpatient clinic of the Pulmonary Division of TMGH, (3) have been clinically diagnosed as having chronic obstructive pulmonary disease (COPD), and (4) continuously receiving LTOT under the supervision of qualified chest physicians. The clinical diagnosis of COPD was made according to the criteria laid down by the American Thoracic Society [5] and among these patients, 157 patients with a clinical diagnosis of COPD were enrolled. Patients whose disease was

predominantly sequelae of pulmonary tuberculosis and those with restrictive lung disorders as determined by pulmonary function testing were excluded. The guidelines for prescribing LTOT were those issued by the Japan Thoracic Society [6, 7]. The minimal criteria are as follows : Patients with chronic respiratory failure of (1) PaO2≦55 Torr in room air at rest, or (2) 55<PaO2≦60 Torr in room air at rest associated with pulmonary hypertension or with severe hypoxemia during exercise or sleep. However, patients with PaO2>60 Torr at rest but with severe hypoxemia during exercise or sleep were prescribed LTOT on the basis of the physician's judgment. Oxygen therapy was prescribed for at least 15 hrs/day, usually for more than 18 hours, and oxygen was supplied by a concentrator at home in all cases, and small oxygen cylinders with a demand valve system were supplied in sufficient numbers for all cases who fulfilled the previously described criteria. The total duration (hours) of use of the concentrator by each patient was confirmed by reading an integrating meter. Treatment for COPD other than LTOT was administered according to the guidelines for comprehensive pulmonary rehabilitation [8] depending on the discretion of the physicians, and usually included, either singly or in combination, an inhaled b2 agonist, inhaled anticholinergic drug, inhaled glucocorticoid, or sustained-release methylxanthines. In cases of acute exacerbation, the patients were managed in a hospital setting at TMGH. Cases for which permission for postmortem study was obtained were evaluated for the cause of death.

All data were obtained at the time of initiation of LTOT. Dyspnea was classified into five grades by the Medical Research Council breathlessness scale [9].

All cases with a history of gastrointestinal complaints were subjected to gastrofiberscopy for the diagnosis of peptic ulcers, because of the high prevalence of peptic ulcers in the elderly in Japan. The diagnosis of ischemic heart disease was made by electrocardiography and echocardiography. The existence of malignancy was confirmed by histopathological examination of a biopsy specimen or during postmortem examination.

Statistical Analysis: Thirty-four variables were selected on the basis of hitherto published evidence [10-21] of their relationship to survival in patients with COPD (Table 1). To determine factors related to the prognosis of COPD, univariate analysis was performed by Kaplan-Meier survival estimates and Cox's proportional hazards model. According to the results of monovariate analysis, multivariate analysis was also performed on selected variables by stepwise analysis on Cox's proportional hazards model [22].

All variables are expressed as mean ± standard error (SE). P values < 0.05 were considered significant.

Results

From May, 1983, to January, 1994, a total of 157 COPD patients were registered. The patients characteristics at the start of LTOT are shown in Table 2. The patients comprised 121 men and 36 women with a mean age of 79.2 years, including 83 patients with pure COPD, 40 with COPD with asthma, and 34 with COPD with sequelae of post primary tuberculosis. The mean duration of LTOT was 2.81 years. Mean compliance with respect to use of the concentrator was 89%, and the concentrator was used for a mean of 21.4 hrs/day.

By December 31, 1995, 96 patients (61.2%) had died and 13 (8.3%) were lost to follow up. In most cases, death was related to respiratory failure due to the progression of COPD and lower respiratory tract infection (n=70; 72.9%) or cancer, including all organs (n=9; 9.4%). Other major causes of death were acute myocardial infarction or cerebrovascular disease (n=17; 17.7%).

The survival rate among COPD patients receiving LTOT was significantly lower than the predicted survival rates in age- and sex- matched groups in the general population [23]. The overall 5-yr survival rate was 21.6%. The median survival was 3.01 years (Fig 1).

There were no significant differences in survival rate between groups over and under 80 yr of age (Fig 2). When survival rates were compared among three different groups in terms of the FEV1/FVC ratio (%), patients with lower ratios survived significantly longer than the other two groups (Fig 3).

Among all variables, survival rates were significantly higher in patients with higher % ideal body weight (IBW) and patients with IBW of >90% ($p<0.01$) (Fig 4). Furthermore, with regard to other nutritional factors, patients with a body mass index (BMI) over 20 as opposed to under 16 ($p<0.01$) (Fig 5) and those with serum albumin concentrations over 4.0g/dl as opposed to under 3.5 g/dl showed higher survival rates ($P<0.01$) (Fig 6).

When the survival rates were compared by dyspnea ranking, survival among patients with higher dyspnea rankings (grades 4 and 5) were significantly lower than for patients with lower dyspnea rankings ($p<0.01$) (Fig 7). However, a comparison of patients with an initial PaO2 over 60 Torr with those under 60 Torr showed no difference is the survival rates (Fig 8).

Univariate analysis of predictors of mortality in COPD patients receiving LTOT are shown in Table 3. There was a significant bivariable relationship between survival time and the following factors: %IBW, BMI, serum albumin concentration, coexistence of malignancy, coexistence of bronchiectasis, dyspnea ranking, FEV1/FVC% and blood hemoglobin level.

With regard to FEV1/FVC%, patients with lower values (40.05-50.05%) had a better outcome than those with higher values over 50% ($p<0.05$).

Among these eight variables,

multivariate analysis was also performed by stepwise analysis on Cox's proportional hazards model. As shown in Table 4, %IBW (>85), dyspnea ranking (ranks 4 and 5), and the coexistence of malignancy independently influenced the survival of COPD patients receiving LTOT.

Discussion

We have elucidated factors that influence outcome in COPD patients who start to receive LTOT near the close of the mean life span. The mean initial age and duration of LTOT in the patients enrolled in this study were 79.2 yr and 2.81 years, respectively. A recent government report in Japan indicated that the average life expectancy in Japanese males and females is 77.01 and 83.59 yr, respectively, both among the best in the world [23], and a still longer longevity is anticipated. Present data indicate that the overall 5-year survival rate in our patients was only 21.6%. This survival rate is much shorter compared with that reported by the Medical Research Council Working Party [1] or Nocturnal Oxygen Therapy Trial Group [2], since cases over 70 yr were excluded by both NOTT and the BMRC Working Party. We were surprised to observe that elderly patients who began LTOT at an age of 79.2 yr could continue LTOT for only 2.81 yrs; however, a fatal outcome at a mean age of 82.01 yr suggests that LTOT might allow a slightly longer survival reaching the mean life expectancy the general population in patients who are not severely affected.

Univariate analysis of predictors of fatal outcome in elderly COPD patients receiving LTOT
(Table 3) showed the outcome to be influenced by the following eight variables : %IBW and BMI, serum albumin concentration, coexistence of malignancy, dyspnea ranking
(rank 4 and 5), FEV1/FVC%, coexistence of bronchiectasis as determined by chest computed tomography, and hemoglobin level (hemoglobin <11.0 g/dl). Furthermore, multivariate analysis of predictors (Table 4) indicated the following three to be major factors worsening outcome : %IBW($\leqq$85), ranking of dyspnea (rank 4 and 5), and coexistence of malignancy.

In a number of studies of patients with severe COPD, survival was found to be influenced by nutritional status [15,18,24,25]. Wilson and coworkers [15] found that in COPD patients, body weight for height has an independent effect on patient survival after controlling for FEV1, total lung capacity, exercise capacity, and resting heart rate. Chailleux and coworkers [24] found that among patients with COPD receiving LTOT, underweight status was a strong predictor of mortality after controlling for age, gender, PaO2, and PaCO2. A recent study by Gray-Donald and coworkers [18] showed in COPD patients, low BMI is independently correlated with respiratory mortality but not with total mortality. Our results also showed that in elderly COPD patients in this study population, malnutritional

status, such as a low %IBW, is an independent prognostic factor.

An interesting findings in this study is a high ranking of dyspnea but not PaO2 in relation to poor prognosis. In COPD patients, it is known that dyspnea deteriorates the activities of daily living (ADL). It has also been shown that poor performance status and ADL are associated with higher mortality rates [19]. Although dyspnea at rest or exertion is not a criterion for LTOT, improvement of dyspnea with oxygen inhalation is known [26], and various mechanisms including improvement of ventilatory drive, minute ventilation, ventilatory muscle fatigue, and direct central perception have been speculated. However, perception of severe dyspnea is a major limiting factor for daily activity in elderly COPD patients [27]. But whether LTOT improves chronic dyspnea and quality of life (QOL) has not been systematically studied [27]. Various benefits of LTOT for patients with severe COPD are known [25,28], and elderly patients approaching the average life expectancy may benefit as well. A recent study by the ANTADIR group reported that patients with severe COPD prescribed LTOT with PaO2 greater than 60 Torr have a similar prognosis compared with more hypoxemic patients [29]. The mean age of patients in their study was approximately 60 yr, 15 yr younger, than in our study, but the results are quite similar. The results of ANTADIR and the present study indicate that the effects by LTOT need to be studied in terms of improvement of dyspnea, ADL and QOL in patients with severe COPD who already have the stated disability. In particular, special emphasis needs to be placed on older patients whose age is close to the average life expectancy, as in the present study.

In conclusion, we have analyzed factors that influence outcome in elderly COPD patients receiving LTOT. The overall 5-year survival rate in COPD patients receiving LTOT in our study was only 21.6%, although LTOT might produce a better outcome in younger patients. Three major variables were found to affect outcome: malnutrition, dyspnea ranking, and the coexistence of malignancy. Dyspnea ranking is a major limiting factor of ADL and QOL in disabled elderly COPD patients. The benefits of LTOT should be assessed from this standpoint.

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Figure Legends

Fig 1. Changes in cumulative survival rates in elderly COPD patients receiving long-term oxygen therapy.

Survival rates in the present study and in the general population were compared. The survival rates declined linearly for five years after the introduction of long-term oxygen therapy.

Fig 2. Changes in cumulative survival rates between groups aged over and under 80 yr of age.

The survival rates between the two groups did not differ.

Fig 3. Changes in cumulative survival rates among three groups according to FEV1/FVC (%).

The highest FEV1/FVC (%) value was associated with the poorest survival rate, while, the lowest FEV1/FVC (%) value was associated with the longest survival rates among the three groups ($P<0.05$).

Fig 4. Changes in cumulative survival rates among three groups according to % ideal body weight.

The highest % ideal body weight (%IBW) was associated with the best cumulative survival rates, whereas the smallest %IBW appeared to be associated with the poorest cumulative survival rate ($P<0.01$).

Fig 5. Changes in cumulative survival rate among three groups according to body mass index.

The largest body mass index (BMI) was associated with the best cumulative survival rates, whereas the smallest BMI appeared to be associated with the poorest cumulative survival rates
($P<0.01$).

Fig 6. Changes in cumulative survival rates among three groups according to serum albumin concentration.

The highest serum albumin concentration was associated with the best cumulative survival rates, whereas the lowest serum albumin concentration appeared to be associated with the poorest cumulative survival rates ($P<0.01$).

Fig 7. Changes in cumulative survival rates among two groups according to dyspnea ranking.

When the survival rates were compared by dyspnea ranking, higher dyspnea ranking
(grades 4 and 5) showed significantly lower survival rates than lower dyspnea rankings
($p<0.03$).

Fig 8. Changes in cumulative survival rates between groups with PaO2 over and under 60 Torr.

The survival rates between the two groups did not differ

Table 1 The thirty-four variables analyzed in this study

Baseline disease	PaO_2	WBC
Cor pulmonale	$PaCO_2$	Lymphocyte number
Bronchiectasis	$AaDO_2$	Lymphocyte %
Gastric ulcer	FEV_1%, predict	Body Height
Gastric ulcer (post therapy)	FEV_1/FVC%	Body Weight
Arrhythmia	MVV	%IBW
Hypertension	VC	BMI
Ischemic heart disease	FEV_1	Arm span
Malignancy	RV/TLC%	Total serum protein concentration
Smoking history (pack · year)	FEV_1/VC %	Serum albumin concentration
The duration of LTOT		Serum hemoglobin concentration
Sex		
Age		

Table 2 Characteristics of patients at the start of LTOT

Variables		All patients (n=157)
Age, y		79.2±6.01
Sex		
Male, %	n=121	77.1
Female, %	n=36	22.9
Period of LTOT, y		2.81
FEV_1, ℓ		0.80±0.39
FVC, ℓ		1.72±0.61
FEV_1/FVC, %		48±17
Body mass index, kg/m^2		18.6±3.8
%IBW, %		91.5±19.5
PaO_2, mmHg		67.0±12.95
$PaCO_2$, mmHg		42.8±8.56
Dyspnea ranking		3.79±0.89
Serum Albumin, g/dℓ		3.85±0.43
Hemoglobin, g/dℓ		12.47±1.66
Breakup of diagnosis of COPD		
COPD, %	n=83	52.9
COPD+BA, %	n=40	25.5
COPD+Post Tbc, %	n=34	21.6

IBW : Ideal Body Weight, BA : Bronchial asthma, Post Tbc : Post pulmonary tuberculosis sequelae

Table3 Univariate analysis of predictors of mortality in COPD patients receiving LTOT

Factors	poor outcome (no, no of %)	better outcome (no, no of %)	β-SE	Hazard Ratio	95% CI
%IBW	85≧ (67, 46.5%)	85< (77, 53.5%)	0.7660±0.2147	2.151 ***	1.41-3.28
BMI	18≧ (77, 53.5%)	18< (67, 46.5%)	0.7598±0.2215	2.138 ***	1.38-3.30
Serum albumin concentration	3.5≧ (72, 29.2%)	3.5< (102, 70.8%)	0.5940±0.2285	1.811 **	1.16-2.83
Malignancy	yes (31, 21.5%)	no (113, 78.5%)	0.6134±0.2360	1.847 **	1.16-2.93
Dyspnea ranking	4, 5 (95, 66.0%)	2, 3 (49, 34.0%)	0.5554±0.2445	1.743 *	1.08-2.81
$FEV_1/FVC\%$	50≧ (50, 34.7%)	50< (94, 65.3%)	0.4557±0.2167	0.634 *	0.42-0.77
Bronchiectasis	yes (4, 2.9%)	no (140, 97.1%)	1.3757±0.5201	3.958 **	1.43-10.97
Serum hemoglobin concentration	11.0≧ (30, 20.8%)	11.0< (114, 79.2%)	0.6178±0.2398	1.855 **	1.16-2.97

* $p<0.05$, ** $p<0.01$, *** $p<0.001$

Table 4 Multivariate analysis of predictors of mortality in COPD patients receiving LTOT

	Hazard Ratio	95% CI
%IBW (≦85 vs >85)	2.078 **	1.32-3.26
Serum albumin concentration (≦3.5 vs >3.5)	1.424	0.88-2.30
Malignancy (yes vs no)	2.023 **	1.24-3.30
Dyspnea ranking (4, 5 vs 2, 3)	2.040 **	1.20-3.47
$FEV_{1.0}$/FVC% (≦50 vs >50)	0.521 **	0.33-0.82

** $p<0.01$

Figure 1 Survival rates in COPD patients receiving LTOT

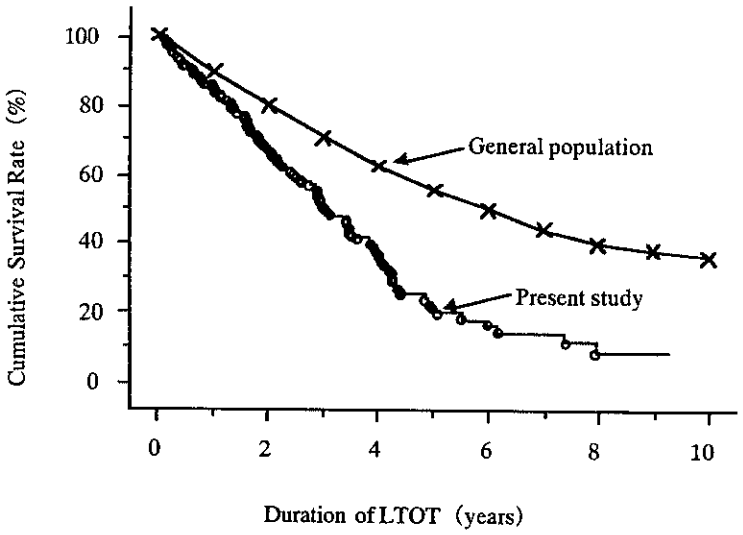

Figure 2 Changes in cumulative survival rates between groups aged over and under 80 yr of age.

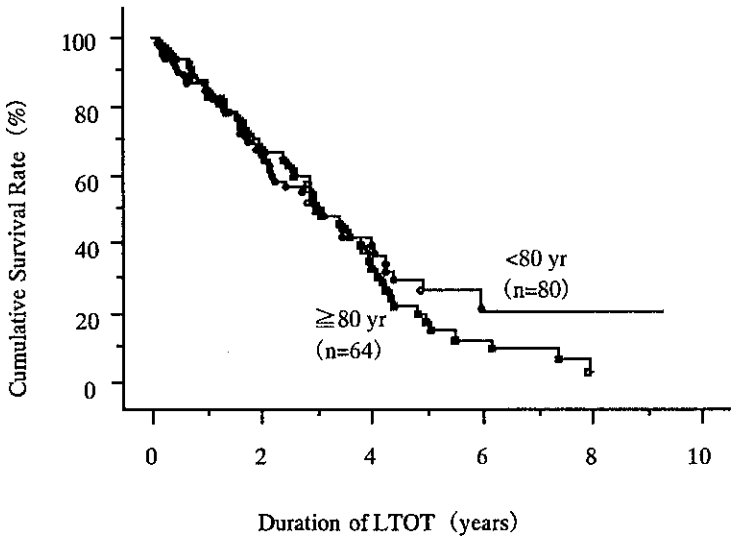

Figure 3 Changes in cumulative survival rates among three groups according to FEV1/FVC (%).