

## Measurement of respiratory sensation in patients referred for lung transplantation

Ocena odczuwania duszności u chorych kwalifikowanych do przeszczepu płuc



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### Abstract

The aim of the study was to evaluate dyspnoea sensation and its relation to clinical data and quality of life in patients referred for lung transplantation (LT). To measure respiratory sensation, the Medical Research Council questionnaire (MRC), Oxygen Cost Diagram (OCD), Baseline Dyspnoea Index (BDI) and Borg's scale were used, whereas quality of life was evaluated with SF-36 and SGRQ. The study group consisted of 18 females and 68 males of average age of 52 ±10 years. 30 patients were diagnosed with idiopathic pulmonary fibrosis (IPF), 22 – COPD and 34 – other than IPF form of idiopathic interstitial pneumonia other than IPF (IIP). The mean values for the clinical rating of breathlessness were in the upper limit in all clinical ratings of dyspnoea. In the reference group, there was a statistically significant correlation between dyspnoea and quality of life and physiologic measurements, especially 6 MWT (six-minute walking test). The correlation found between the level of dyspnoea and quality of life domains suggests that it would be worthwhile to add questions regarding dyspnoea to assess the severity of the disease, clinical symptoms and functional impairment when referring the patients for lung transplantation.

**Key words:** lung transplantation, dyspnoea, quality of life.

### Introduction

The Medical University of Silesia is the only centre in Poland where lung transplantations (LT) are performed. Patients are referred for lung transplantation to the Dpt. of Lung Diseases and Tuberculosis in Zabrze. The selection of patients for lung transplants involves the estimation of

### Streszczenie

Celem pracy jest ocena odczuwania duszności w odniesieniu do danych klinicznych i jakości życia u chorych kwalifikowanych do przeszczepu płuc. Duszność oceniano za pomocą kwestionariusza *Medical Research Council* (MRC), *Oxygen Cost Diagram* (OCD, diagram kosztu tlenowego), *Baseline Dyspnoea Index* (BDI, podstawowy indeks duszności) i skali Borga, podczas gdy jakość życia była mierzona za pomocą kwestionariusza SF-36 i SGRQ (*St. Georges Respiratory Questionnaire*, Kwestionariusz Szpitala św. Jerzego). Badana grupa składała się z 18 kobiet i 68 mężczyzn, średnia wieku wynosiła 52 ±10 lat. U 30 chorych rozpoznano idiopatyczne włóknienie płuc (IPF), u 22 – POChP, a u 34 – inne niż IPF postacie śródmiąższowych zapaleń płuc (IIP). Średnie wartości ocen duszności mieściły się w zakresie górnych wartości poszczególnych klinicznych skal duszności. W badanej grupie stwierdzono korelację między skalami ocen duszności a jakości życia oraz wynikami badań klinicznych, szczególnie między odczuwaniem duszności a wynikami testu 6-minutowego chodu (6 MWT). Korelacje stwierdzone między poziomami odczuwanej duszności a domenami kwestionariuszy jakości życia sugerują, iż pytania dotyczące stopnia odczuwania duszności należy dodać do oceny ciężkości choroby, objawów klinicznych i upośledzenia czynnościowego w trakcie kwalifikacji chorych do przeszczepu płuc.

**Słowa kluczowe:** przeszczep płuc, duszność, jakość życia.

disease progress. Dyspnoea is the cardinal symptom of the failing lung that significantly affects all elements of quality of life (QL). The main goal of LT, instead of increase of life expectancy, is improvement of quality of life (QL). Each patient when being referred for LT has accurate estimation of QL performed. Tests specific for end-stage, advanced lung

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diseases have not been invented yet. Among the available tests, the SF-36 questionnaire assesses both physical and mental conditions. Saint Georges Respiratory Questionnaire (SGRQ), specific to chronic lung diseases, evaluates quality of life in three domains: symptoms, activity and impact on life. The aim of the study was to determine a relationship between quality of life and dyspnoea in patients awaiting lung transplantation, and to assess whether they are related to the clinical data in the examined group.

## Material and methods

### Study population

86 patients, all of them qualified for LT in 2005-2010 and fulfilling ISHLT criteria for lung transplantation [1, 2] were evaluated. The study group consisted of 18 females and 68 males of average age of  $52 \pm 10$  years and BMI  $24 \pm 6$ . Thirty patients were diagnosed with idiopathic pulmonary fibrosis (IPF), 22 with COPD and 34 with a form of idiopathic interstitial pneumonia other than IPF (IIP). To avoid the potential influence of medication on the ratings of dyspnoea, only patients free of exacerbations of the disease for at least 48 hours were included. The study was approved by the Medical University of Silesia's Review Board, and informed consent was obtained.

### Rating of dyspnoea

Four different clinical methods were used for rating dyspnoea at a point in time: a modification of the Medical Research Council questionnaire (MRC) [4], Oxygen-Cost Diagram (OCD) [5], Baseline Dyspnoea Index (BDI) [5] and Borg's scale [6].

MRC is a 5-grade scale that grades the degree of breathlessness related to activities. In our study, each patient was instructed to read the descriptive statements and then select the number which best fitted his shortness of breath. For descriptive and statistical reasons MRC was modified so that lack of breathlessness except for strenuous exercise was marked as grade 1; the maximal level of dyspnoea, when too breathless to leave the house or breathless when dressing or undressing was marked as grade 5. OCD is a visual-analogue scale consisting of a 100 mm long line with descriptions of different activities causing dyspnoea. The top of the vertical line represents "no breathlessness – brisk walking uphill" (grade 1), while the bottom of the line reflects "the greatest breathlessness – even when sleeping" (grade 5). The patient was instructed to "mark the line at a point above which you would become breathless". The distance from the bottom of the scale to the patient's mark was measured in millimetres and provided a quantification of the subject's dyspnoea.

The BDI describes dyspnoea in five grades for each of three categories: disability of everyday activities (FI, functional impairment), difficulties in performing tasks (MT, magnitude of task), and difficulties in undertaking an effort (ME, magnitude of effort). This scale enables differentiation of extra-pulmonary causes of dyspnoea; e.g. osteoarthritis pain, chest pain, and situations where it is not possible to define the causes of dyspnoea. In such cases, the patient

marks a relevant answer that is not classified in dyspnoea estimation. Visual Borg Scale rates patients' dyspnoea from 0 (rest) to 10, where 10 is the maximum dyspnoea ever.

### Physiologic measurements

Physiologic testing was completed on the same day when dyspnoea was graded. Lung function tests and mobility, patient's age, BMI and duration of symptoms (years) were taken into consideration.

Spirometry was performed using Jaeger-Masterlab (Erich Jaeger GmbH, Wurzburg, Germany). Two lung function parameters were measured: forced vital capacity (FVC) and forced expiratory volume in one second (FEV1), and were normalized to the reference values proposed by the European Community for Coal and Steel and presented as a percentage of predicted (% pred.). Mobility was presented as a distance in 6 minute walking tests (6MWT). The test was performed according to the guidelines of the American Thoracic Society [7].

### Quality of life

In estimation of Quality of Life the **SF-36 questionnaire** [8] – generally describing Quality of Life and **St. George Respiratory Questionnaire** [9] – characteristic of chronic lung diseases were used. The **SF-36 questionnaire** consists of 36 questions, which cover basic domains describing the condition of health: 1) Physical Functioning (PF), 2) Role Physical (RP), 3) Bodily Pain (BP), 4) General Health (GH), 5) Vitality (VT), 6) Social Functioning (SF), 7) Role Emotional (RE), 8) Mental Health (MH). In SF-36 scoring, the higher scores meant better general health status. Methodical rules and the analysis of data by SF-36 questionnaire had been earlier described in the previous paper [10]. **St. George Respiratory Questionnaire** composed of 50 questions, is grouped in 3 subscales: symptoms, activity and influence on life. Each scale responds to an experimentally set number of points. The points are pooled together in each subscale and divided by the maximal number of points in each subscale. The received score varies between 0 (minimum handicap) and 100 (maximum handicap). Simultaneously a global outcome of the questionnaire was calculated. The agreement of Prof. Jones, the author of SGRQ was obtained before the research program started.

### Statistical analysis

Results are expressed as mean  $\pm$  SD. Spearman's rank correlation coefficient was used to measure statistical dependence. A correlation between results of dyspnoea tests and physiologic testing, spirometric data, mobility, and quality of life questionnaires' domains were determined. Analysis was performed using the Statistica programme. Statistical significance was defined as  $p < 0.05$ .

### Results

Patient characteristics Anthropometric data and results of lung function and mobility are presented in Table I. Gen-

**Tab. I.** Characteristics of patients depending on diagnosis

Disease	Total	COPD	IPF	IIP
No. of patients	86	22	30	34
Male/female	66/18	18/4	24/6	26/8
Age, yr	51.7 ±10.7	54.9 ±6.6	52.2 ±9.9	49.3 ±13.0
BMI	23.8 ±4.5	22.7 ±3.8	24.9 ±4.5	23.2 ±4.8
Disease duration, yr	18.0 ±5.1	18.8 ±4.7	7.6 ±4.9	17.8 ±5.6
FEV1, L	1.3 ±0.9	0.8 ±0.4	1.5 ±0.8	1.5 ±1.0
FEV1, %pred.	31.5 ±20.0	18.7 ±9.6	41.2 ±20.4	32.5 ±21.0
FVC, L	1.9 ±0.9	1.8 ±0.8	1.9 ±0.9	2.1 ±1.2
FVC, %pred.	42.4 ±18.8	42.6 ±13.9	42.5 ±21.0	42.8 ±20.1
FEV1%VC	69.5 ±21.5	45.1 ±16.7	83.5 ±12.5	74.7 ±16.7
6 MWT, m	292.6 ±133.5	270.4 ±135.1	293.4 ±164.1	289.6 ±123.7

der was comparable in study groups. Oldest patients were in COPD group (without statistical difference). In COPD group, the disease duration was the longest (nearly 19 yr.) and BMI was the lowest (22.7, without statistical significance in comparison to IPF or IIP). Patients with IPF and IIP exhibited significantly highest ( $p < 0.05$ ) levels of FEV1 compared to COPD patients. Mean results of FVC and walking ability (6 MWT) were similar in all study subgroups (COPD, IPF and IIP), and under the level of 50% of predicted values (FVC, 6 MWT).

### Dyspnoea evaluation

The mean values for the clinical rating of breathlessness were in the upper limit in all clinical ratings of dyspnoea (Table II). Values obtained by the clinical rating methods of breathlessness were highly interrelated (MRC vs. OCD,  $r = 0.85$ ; MRC vs. BDI,  $r = 0.87$ ; MRC vs. Borg's scale,  $r = 0.78$ ; BDI vs. OCD,  $r = 0.88$ ; BDI vs. Borg's scale,  $r = 0.86$ ). There were no statistically significant differences in perception of dyspnoea between COPD, IPF and IIP in all clinical ratings. Nevertheless, the highest perception of breathlessness was observed in IIP in all scales (Table II); in those groups the highest values of min and max scores were observed, too. Instead of FI, COPD patients presented mean values of dyspnoea below mean values observed in the total study population. IPF patients presented the lowest perception of dyspnoea in FI and ME of BDI in comparison to COPD and IIP and mean total values (without statistical significance), as well. In remaining descriptors of breathlessness for IPF, mean values were similar to mean values observed in the total study population.

### Quality of life evaluation

In SGRQ most impaired quality of life domain was activity (76.29 ±14.25) whereas the least affected domain was symptoms (64.49 ±18.36). The global score indicates the poorest quality of life in COPD patients (72.84 ±11.19), the best score was achieved in a group of patients diagnosed with IPF (68.09 ± 13.86) (Table III). No statistically significant differences were found in SGRQ domains between patients with different diagnosis. Quality of life evaluated with SF-36 questionnaire is most

impaired in RP domain (16.17 ±22.55), least in BP domain (48.77 ±22.14). Basing on cumulative scores, the smallest PCS impairment was discovered in COPD patients (25.09 ±8.34), the biggest (25.95 ±6.39) in IIP patients. Mental cumulative health score was the highest in IPF patients (42.44 ±14.24), and the lowest in COPD patients (37.83 ±15.27) (Table III). No statistically significant differences were found in SGRQ domains between patients with different diagnosis.

### Dyspnoea and quality of life

In the study group, there was a statistically significant correlation between dyspnoea and quality of life (Table IV). Domains: Activities and Impact of SGRQ correlate significantly with all clinical ratings of dyspnoea of our study (MRC, OCD, BDI and Borg's scale). In most cases the correlation was very strong ( $p < 0.001$ ). No relations were found between symptoms of SGRQ and clinical ratings of dyspnoea. Correlations between clinical ratings of dyspnoea and domains of SF-36 questionnaire were noticed, too. They were most wide between BDI and GH, Vit, SF and PCS. With the exception of Borg's scale, correlations were observed between the clinical rating of dyspnoea and PCS. No correlations were observed between MCS and clinical ratings of dyspnoea.

Depending on the diagnosis, the strongest correlation in IIP patients was found between OCD and activity ( $r = 0.62$ ), in COPD patients between BDI and impact ( $r = 0.79$ ) and in IPF patients between BDI and PF ( $r = 0.60$ ).

There was no correlation between BMI and dyspnoea and quality of life questionnaires' domains.

### Ratings of dyspnoea and physiologic measurements

There was no correlation found between gender, age, disease duration, BMI and clinical ratings of dyspnoea (MRC, OCD, BDI, Borg). However, there was a correlation between mobility, lung function tests and rating of dyspnoea. Most often correlations were seen between dyspnoea domains and distance in 6 MWT (Fig. 1). It was observed not only in whole populations, but also in patients with COPD (6 MW

Tab. II. Dyspnoea evaluation

		Total	COPD	IPF	IIP
MRC	mean ±SD	3.56 ±0.71	3.50 ±0.91	3.34 ±0.67	3.82 ±0.48
	min	1.0	1.0	2.0	3.0
	max	5.0	4.0	4.0	5.0
OCD	mean ±SD	3.94 ±0.94	3.86 ±1.2	3.90 ±0.86	4.06 ±0.79
	min	1.0	1.0	2.0	2.0
	max	5.0	5.0	5.0	5.0
FI+MT+ME	mean ±SD	12.46 ±1.71	12.22 ±2.0	12.24 ±1.70	12.89 ±1.44
	min	7.0	7.0	9.0	10
	max	15.0	15.0	15.0	15
BDI	mean ±SD	4.38 ±0.68	4.40 ±0.67	4.21 ±0.73	4.55 ±0.63
	min	3.0	3.0	3.0	3.0
	max	5.0	5.0	5.0	5.0
MT	mean ±SD	3.96 ±0.75	3.72 ±0.98	4.00 ±0.65	4.13 ±0.58
	min	1.0	1.0	3.0	3.0
	max	5.0	5.0	5.0	5.0
ME	mean ±SD	4.11 ±0.59	4.09 ±0.68	4.03 ±0.57	4.20 ±0.55
	min	2.0	2.0	3.0	3.0
	max	5.0	5.0	5.0	5.0
Borg's scale	mean ±SD	5.93 ±2.33	5.45 ±2.47	5.66 ±2.59	6.57 ±1.74
	min	0	0	1	3
	max	10	8	10	10

Tab. III. Quality of life evaluation (mean ±SD)

		Total	COPD	IPF	IIP
SGRQ	Symptoms	64.49 ±18.36	67.20 ±16.70	62.86 ±17.66	63.31 ±19.89
	Activity	76.29 ±14.25	78.03 ±13.87	72.78 ±15.05	78.61 ±13.61
	Impact	72.69 ±14.41	75.07 ±12.94	70.23 ±17.36	73.45 ±12.56
	Global score	70.50 ±12.71	72.84 ±11.19	68.09 ±13.86	70.90 ±12.72
SF-36	PF	19.25 ±15.93	24.30 ±18.76	19.09 ±17.05	15.39 ±11.54
	RP	16.17 ±22.55	17.95 ±14.04	20.72 ±23.15	17.41 ±25.35
	BP	48.77 ±27.14	53.94 ±27.24	47.32 ±25.92	47.17 ±28.78
	GH	25.93 ±11.86	27.68 ±13.26	28.51 ±10.69	23.05 ±11.14
	Vit	37.45 ±16.97	35.35 ±14.37	38.68 ±19.82	37.79 ±16.39
	SF	32.96 ±24.63	37.89 ±28.96	33.35 ±26.04	29.93 ±20.17
	RE	35.55 ±36.77	32.41 ±38.77	40.26 ±36.89	34.26 ±36.29
	MH	47.63 ±21.44	51.74 ±18.84	49.22 ±22.78	43.66 ±22.04
	PCS	25.77 ±7.25	25.09 ±8.34	25.89 ±7.8	25.95 ±6.39
	MCS	39.63 ±13.63	37.83 ±15.27	42.44 ±14.24	38.45 ±12.14

Tab. IV. Correlations between clinical rating of dyspnoea and quality of life

Clinical dyspnoea ratings	Quality of life												
	SGRQ			SF-36									
	Symptoms	Activities	Impact	Pf	RP	Bp	GH	Vit	SF	RE	MH	PCS	MCS
MRC	0.12	0.39**	0.25*	-0.53**	-0.01	-0.11	-0.06	-0.01	-0.02	-0.05	-0.02	-0.25*	-0.04
OCD	0.25	0.56**	0.47**	-0.55**	-0.01	-0.06	-0.01	-0.11	-0.19	-0.03	-0.11	-0.35*	-0.04
BDI	0.13	0.29*	0.51**	-0.43**	-0.01	-0.05	-0.24*	-0.24*	-0.25*	-0.21	-0.15	-0.24*	-0.20
Borg's scale	0.13	0.38**	0.46**	-0.42**	-0.15	-0.06	-0.02	-0.16	-0.13	-0.02	-0.24*	-0.17	-0.10

\*  $p < 0.05$ ; \*\*  $p < 0.001$ .

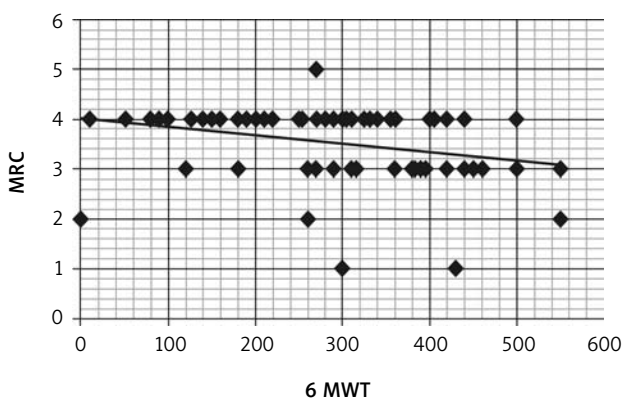
vs. MRC:  $r = -0.70$ , 6 MW vs. OCD:  $r = -0.51$ , 6 MW vs. BDI:  $r = -0.68$ , 6 MW vs. Borg's scale:  $r = -0.46$ ) and IPF. In IPF patients, a strong correlation was observed between rating of dyspnoea and lung function tests (FVC, FVC%pred., FEV1, FEV1%pred, FEV1%VC), too. In COPD patients, correlations were observed between rating of dyspnoea and FEV1 and FEV1%VC, instead of 6 MW. No correlations were observed between dyspnoea and lung function tests in patients with IIP.

**Discussion**

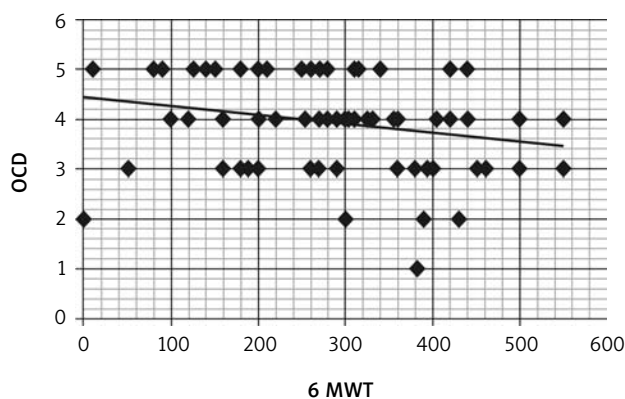
The results of this study are preliminary, being limited by the small number of patients in the sample of groups with different lung diseases referred for LT. Nonetheless, we noticed that patients with advanced lung diseases on the waiting list for LT showed great impairments in their rating of dyspnoea. We believe that the clinical measurement of dyspnoea is important in patients referred for LT for several reasons. First, breathlessness is frequently the patient's major complaint in advanced lung diseases. By quantifying dyspnoea, the physician can assess its severity

and impact on the person's health status. It is most important in patients referred for LT when accurate estimation of health status plays a crucial role on placing lung recipients on the waiting list. Second, as a symptom, breathlessness represents the summation of physiologic factors which collectively provide a distressing signal to the patients. And finally, grading the dyspnoea is an important consideration for establishing efficiency of treatment. At present, except for oxygen, lung transplantation is the only one objective evidence that may benefit in length of life and quality of life. So accurate rating of dyspnoea in patients waiting for LT seems to be very important in the future, when the benefit of LT is being estimated in every patient. Dyspnoea scores from all four methods were significantly correlated between each other in our study. It was previously reported by authors describing in detail clinical methods for rating dyspnoea [11-13]. However, in our opinion BDI provides more quantitative information which is complementary to physiologic testing and assessing quality of life. BDI, which includes the components of functional impairment and magnitude of effort affecting breathlessness along with magnitude of task, for each of these three components de-

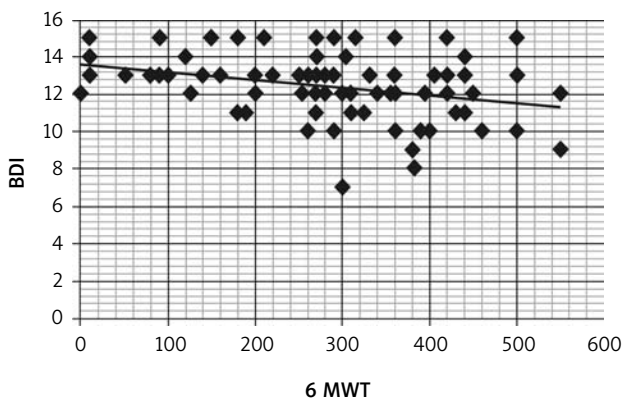
MRC vs. 6 MWT  $r = -0.3902$ ,  $p < 0.05$



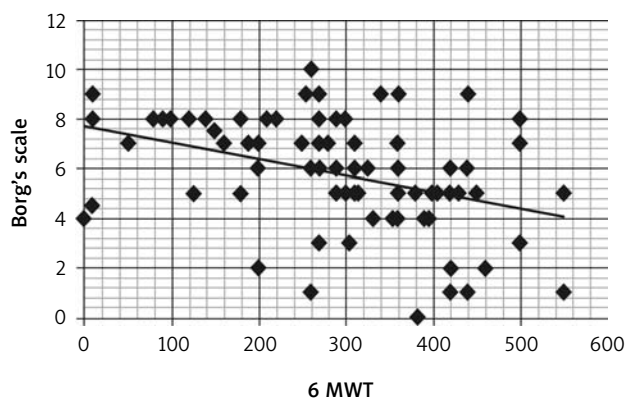
OCD vs. 6 MWT  $r = -0.2586$ ,  $p < 0.05$



BDI vs. 6 MWT  $r = -0.3177$ ,  $p < 0.05$



Borg's scale vs. 6 MWT  $r = -0.4119$ ,  $p < 0.05$



**Fig. 1.** Correlations between ratings of dyspnoea and result in 6 MWT [m]

monstrate differences. In our study those differences were not statistically significant, but from the clinical point of view, they are very important. For example, a patient may require extraordinary effort to accomplish a relatively easy task, and the corresponding ratings for these components of the BDI would be distinctly different. Also, the demands of an individual task may have totally different consequences depending on a person's activities at work or home. For these reasons, measurement of specific components affecting dyspnoea appears to be important. Such scales as MRC, OCD and Borg's scale, which could be used as visual scales are useful for rating dyspnoea in documenting changes in breathlessness. Because the MRC scale, which contains only five grades, may be too coarse to demonstrate distinct changes, we believe that a visual scale, such as OCD or Borg's scale is most appropriate for statistical comparisons of changes in perceptions of breathlessness. In our study all of these clinical ratings of dyspnoea demonstrate clinical utility confirmed by significant correlations with quality of life and results of lung function test and mobility. Health-related quality of life is a measure of decrease of physical, mental and social well-being as a result of an illness. Dyspnoea could significantly affect all three elements of health. Those relationships were first time demonstrated by Sifakas et al. [14]. In his study, he noticed that dyspnoea was the main determinant of the overall health status in patients with airway diseases. Dyspnoea correlates with such domains of general health as anxiety, depression, optimism, stigma, sleep and activities of daily living [15]. In our study, in SF-36 questionnaire, which assesses general health status and is focused on the basic values relevant for health, we noticed that domains related to physical and functional alterations presented greater impairment. High scores for vitality, social functioning, role emotional, and mental health could indicate that these patients, even though weak physically, feel sheltered and involved by those around them, such as family members, friends and health care staff. Their expectations were strengthened by the possibility of a lung transplantation. Similar results are presented in a study of Feltrim et al. [16], where physical functioning is the most affected among patients referred for LT. In SGRQ, which is recommended to be used for patients with chronic lung diseases, the questions are geared to symptoms, activities and emotional impact related to the disease. All domains were seriously affected. It was obvious because in our study patients were in the end stage of lung diseases, referred for lung transplantation. All patients displayed dyspnoea as the common symptom of diseases, followed by cough in COPD and IPF. The COPD and IIP groups were the most affected in performing their activities and emotional impact, which were limited due to the complaint of serious dyspnoea. The IPF group reported the least impact of the disease on their quality of life. In our opinion, it could be connected with a relatively short duration of the disease in this group. Activities and emotional impact – domains of SGRQ – correlate positively with all clinical ratings of dyspnoea (MRC, OCD, BDI, Borg's scale). No correlations were

found between symptoms and rating of dyspnoea. Lack of correlations could be explained by the fact that with the exception of dyspnoea, different symptoms were declared in groups with restrictive and obstructive diseases. Dyspnoea scores investigated in our study correlated significantly with mobility, presented as a distance in 6-minute walking test. In our opinion, it is a very important observation. 6 MWT is a well noticed predictive factor when referring patients for LT. In our study, in 2005 we concluded for the first time that 6 MWT defines survival in patients with IPF referred for this procedure [17]. Three years later Martinu et al. [18] confirmed utility of 6 MWT in predicting survival in lung transplant candidates. So adding accurate estimation grade of dyspnoea in lung transplant candidates to physiologic measurements as a 6 MWT or lung function test could help in accurate estimation of indications for referral for LT.

We believe that the clinical measurement of dyspnoea in lung transplant candidates has wide potential application in the practice. The measurement process is reproducible and can be completed in less than five minutes. The cost is minimal, and a nurse, respiratory therapist or physician can grade easily the severity of a patient's breathlessness. The measurement of dyspnoea can be useful in referring patients for LT and in the treatment of even seriously affected patients.

## References

- Orens JB, Estenne M, Arcasoy S, Conte JV, Corris, Egan JJ, Egan T, Keshavjee S, Knopp C, Kotloff R, Martinez FJ, Nathan S, Palmer S, Patterson A, Singer L, Snell G, Studer S, Vachieri JL, Glanville AR. International Guidelines for the Selection of Lung Transplant Candidates: 2006 Update-A consensus Report From the Pulmonary Scientific Council of the International Society for Heart and Lung Transplantation. *J Heart Lung Transplant* 2006; 7: 745-755.
- Jastrzębski D, Wojarski J, Nowak J, Iwiński J, Gumola A, Przybylski R, Poloński L, Kozielski J, Zembala M. Doświadczenie w kwalifikacji chorych z nieodwracalnym uszkodzeniem płuc do transplantacji w Klinice Chorób Płuc i Gruźlicy w Zabrze oraz w Śląskim Centrum Chorób Serca w Zabrze w 2006 roku. *Kardiochir Torakochir Pol* 2007; 1: 49-54.
- Jastrzębski D, Gumola A, Gawlik R, Kozielski J. Dyspnea and quality of life in patients with pulmonary fibrosis after six weeks of respiratory rehabilitation. *J Physiol Pharmacol* 2006; 57 (Suppl. 4): 139-148.
- Fletcher CM. Standardized questionnaire on respiratory symptoms: A statement prepared and approved by the MRC Committee on the aetiology of chronic bronchitis (MRC breathlessness score). *BMJ* 1960; 2: 241-243.
- Baddini Martinez JA, Martinez TY, Lovetro Galhardo FP, de Castro Pereira CA. Dyspnea scales as a measure of health-related quality of life in patients with idiopathic pulmonary fibrosis. *Med Sci Monit* 2002; 8: 405-410.
- Borg GAV. Psychophysical basis of perceived exertion. *Med Sci Sports Exerc* 1982; 14: 377-381.
- American Thoracic Society Statement. Guidelines for the six-minute walk test. *Am J Respir Crit Care Med* 2002; 166: 111-117.
- Ware JE, Kosinski M, Gandek B. SF-36 health survey. Manual & interpretation guide. QualityMetric Incorporated 2004, Lincoln.
- Kuźniar T, Patkowski J. Kwestionariusz Szpitala Św. Jerzego (St. George's Respiratory Questionnaire) jako narzędzie oceny jakości życia w chorobach układu oddechowego. *Pol Arch Med Wewn* 2000; 1: 401-406.
- Jastrzębski D, Kozielski J, Banaś A, Cebula T, Gumola A, Ziara D, Krzywiecki A. Quality of life during one-year observation of patients with idiopathic pulmonary fibrosis awaiting lung transplantation. *Journal Physiol Pharmacol* 2005; 56: 99-106.
- Guyatt GH, Thompson PJ, Berman LB, Sullivan MJ, Townsend M, Jones NL. How should we measure function in patients with chronic heart and lung disease? *J Chron Dis* 1985; 38: 517-524.

12. Mahler DA, Wells C. Evaluation of clinical methods for rating dyspnea. *Chest* 1988; 93: 580-586.
13. Mahler D, Weinberg DH, Carolyn KW, Feinstein AR. The measurement of dyspnea. *Chest* 1984; 6: 751-758.
14. Siafakas NM, Schiza S, Xirouhaki N, Bouros D. Is dyspnoea the main determinant of quality of life in the mailing lung? *Eur Respir Rev* 1997; 7: 53-56.
15. Kaasa S, Mastekaousa A, Stokke I, Neass S. Validation of a quality of life for use In clinical trias for treatment of patients with inoperabile lung cance. *Eur J Cancer Clin Oncol* 1988; 24: 691-701.
16. Feltrim MIZ, Rozanski A, Borges ACS, Cardoso CA, Caramori ML, Pego-Fernandes P. The quality of life of patients on the lung transplantation Whiting list. *Transplant Proceed* 2008; 40: 819-821.
17. Jastrzębski D, Kozielski J, Nowak J, Gumola A, Wojarski J, Zakliczyński M, Poloński L, Zembala M. Oxygen saturation after supplementation through the nasal catheter and 6-minutes walk test as prognostic factors during referral for lung transplantation patient's with idiopathic pulmonary fibrosis. *Kardiochir Torakochir Pol* 2005; 2: 63-67.
18. Martinu T, Babyak MA, O'Connell, Carney RM, Trulock EP, Davis RD, Blumenthal JA, Palmer SM. Baseline 6-min walk distance predicts survival in lung transplant candidates. *Am J Transplant* 2008; 8: 1498-1505.