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Causes of deaths in COPD patients in primary care setting — a 6-year follow-up

Ocena przyczyn zgonów u chorych na przewlekłą obturacyjną chorobę płuc w podstawowej opiece zdrowotnej w okresie sześcioletniej obserwacji

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Abstract

Introduction: COPD is one of the most frequent respiratory diseases responsible for patients' disability and mortality. In 2005 a single primary care practice, COPD was diagnosed in 183 out of 1,960 eligible subjects ≥ 40 years (9.3%). The aim of this study was to assess mortality rate and causes of deaths in this group after 6 years.

Material and methods: In 2011 we invited all 183 patients with COPD recognised in 2005. We performed spirometry, physical examination, questionnaire of respiratory symptoms, smoking habits, concomitant diseases and treatment. Information about deaths was taken from primary care register, furthermore, family members were asked to deliver medical documentation or death certificate.

Results: In 2011 we studied only 74 subjects (40.4%), 43 subjects died (23.5%) and 66 subjects were lost from the follow-up (36.1%). Cardiovascular diseases were the most frequent causes of deaths — 21 subjects (48.8%) (heart attack – 8 patients and stroke – 8 patients). Respiratory failure in the course of COPD exacerbation was the cause of 10 deaths (23.3%). Neoplastic diseases lead to 9 deaths (20.9%) (lung cancer 7 patients). Renal insufficiency was responsible for one death (2.325%), and the causes of 2 deaths remained unknown (4.65%). Subjects who died (predominantly males) were older, had higher MRC score and lower FEV_1.

Conclusions: Study performed six years after COPD diagnosis revealed that 23.5% of subjects died. The main causes of deaths were the following: cardiovascular diseases (mainly heart attack and stroke), COPD exacerbations and lung cancer (more than 75%). Death risk in COPD patients was associated with age, male sex, dyspnoea and severity of the disease.

Key words: mortality, COPD, primary care setting, epidemiology, spirometry

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Streszczenie

Wstęp: POChP jest jedną z najczęstszych chorób układu oddechowego, która prowadzi do inwalidztwa oddechowego oraz przedwczesnej śmierci. W 2005 roku w pojedynczej placówce podstawowej opieki zdrowotnej rozpoznano POChP u 183 spośród zbadanych 1960 osób, które ukończyły 40. rok życia (9,3%).

Celem pracy była analiza częstości zgonów i ich przyczyn w grupie chorych na POChP po 6 latach obserwacji.

Materiał i metody: W 2011 roku na badania kontrolne zaproszono wszystkie 183 osoby, u których rozpoznano POChP w 2005 roku. Badani wypełniali kwestionariusz dotyczący dolegliwości oddechowych, palenia tytoniu, chorób współistniejących oraz aktualnego leczenia. Po weryfikacji kwestionariusza wykonywano badanie przedmiotowe i spirometrię. Informację o śmierci pacjentów uzyskiwano z aktualnej kartoteki POZ oraz od rodzin badanych (na podstawie uzyskanej dokumentacji medycznej — ustalano datę i miejsce zgonu oraz jego przyczyny).

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Wyniki: W 2011 roku zbadano tylko 74 chorych (40,4%), 43 chorych zmarło (23,5%). Pozostałych 66 chorych nie udało się zbadać ponownie (36,1%). Choroby układu krążenia były najczęstszymi przyczynami zgonów u chorych na POChP — 21 chorych (48,8%) (w tym zawał serca — 8 chorych i udar mózgu — 8 chorych). Niewydolność oddychania w przebiegu POChP była przyczyną śmierci u 10 badanych (23,3%). Choroby nowotworowe były odpowiedzialne za 9 zgonów (20,9%) (rak płuc — 7 chorych). Pozostałe zgony wiązały się z niewydolnością nerek (1 chory; 2,325%) oraz przyczynami nieustalonymi (2 chorych; 4,65%). Chorzy na POChP, którzy zmarli (większość stanowili mężczyźni) byli starsi, mieli większe nasilenie duszności w skali MRC oraz niższe FEV_1.

Wnioski: Badania kontrolne wykonane po 6 latach od rozpoznania choroby ujawniły wysoką umieralność w badanej grupie (zmarło 43 chorych — 23,5%). Ponad 75% wszystkich zgonów było spowodowane chorobami układu krążenia (najczęściej zawałem serca i udarem mózgu), zaostrzeniami POChP i rakiem płuc. Czynnikami, które wpływały na wzrost ryzyka zgonu w badanej grupie, były: wiek, płeć męska, większe nasilenie duszności oraz cięższą postać choroby.

Słowa kluczowe: śmiertelność, POChP, podstawowa opieka zdrowotna, epidemiologia, spirometria

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Introduction

Chronic obstructive pulmonary disease (COPD) is one of the most frequent chronic diseases, significance of which is constantly growing. The frequent prevalence of the disease, cost-consuming treatment and rehabilitation (particularly hospitalisations due to exacerbations), consequences such as chronic respiratory insufficiency (the necessity for using oxygen therapy at home or non-invasive assisted ventilation), concomitant diseases (more frequent in comparison to the general population), heart diseases, neoplasms and deaths in the course of COPD, all these factors make the illness not only a serious medical problem but also a social and economic issue.

According to epidemiology data, lung diseases (including COPD as the most frequent) in Poland are the fourth most often encountered cause of death after cardiovascular diseases, malignant neoplasms and unexpected sudden death [1]. The above observations are in accordance with worldwide trends, which in 1997 implied that unless smoking cigarettes becomes less popular, in 2020, COPD will be the third cause of death worldwide [2]. The Global Burden of Diseases, Injuries and Risk Factors Study disclosed that COPD was the third most frequent cause of deaths in 2010 (235 causes of deaths were evaluated in 21 regions of the world, taking into account age and sex) [3]. Mortality from COPD in Europe between 1994 — 2010 was assessed more optimistically [4]. In 27 countries of the European Union (EU) mortality from COPD decreased from 90.07 to 61.33 per 100,000 population (2.56% percent of annual change — PAC) in men, and from 26.99 to 25.15 per 100,000 population (0.76% PAC) in women (age-standardised mortality rates). The evaluation of mortality rate showed an upward trend in 5 countries of the EU for men and in 14 countries for women. As far as Poland is concerned, it confirmed a downward trend in men (by 0.34%, NS) and an upward trend in women (by 1.55%, $p < 0.05$).

The objective of the study was to analyse the frequency and causes of deaths in the group of COPD patients in a single primary care institution 6 years after diagnosis of the disease.

Material and methods

The study group included 183 patients with COPD diagnosed in 2005 in a single primary care institution in Sierpc (NZOZ Medicar) (9.3% of the study population of 1,960 individuals aged ≥ 40 years) [5]. In 2011, the patients received letters or calls inviting them to perform follow-up examination.

At the beginning of the appointment the patient was completing a questionnaire concerning the place of residence (city/village), occupational status (employee — place of work, retiree, pensioner — the reason for a pension), economic status (in a subjective opinion of the respondent: good, satisfying, bad), exposure to tobacco smoke (current and former smokers — subjects who ceased smoking at least 6 months prior to the examination, non-smokers; for the two first groups, the number of pack-years was evaluated), respiratory symptoms (the MRC dyspnoea scale), cough and expectoration of sputum (in the case of a positive answer to the question whether the above symptoms are chronic according to the definition of chronic bronchitis), the number of COPD exacerbations and hospitalisations (since the previous examination), concomitant diseases, current treatment. Afterwards physical examination was made including measurement of height

and body mass. Spirometry was performed using a portable spirometer (EasyOne Diagnostic, model 2001; NDD Medical Technologies, Zurich, Switzerland).

The patients were seated during the procedure. Forced vital capacity (FVC) and forced expiratory volume in the first second (FEV_1) were measured, and FEV_1/FVC ratio was calculated. Spirometry was repeated unless three acceptable and repeatable blows were obtained [6]. After initial procedure, reversibility test was carried out (subsequent spirometry was performed 15 minutes after administration of 400mcg of salbutamol).

The degree of obstruction in COPD patients was evaluated in accordance with the GOLD guidelines [7] using predicted values adopted by the ECSC (European Community for Steel and Coal) [8]. COPD category was classified basing on the severity of obstruction, MRC dyspnoea scale, a number of exacerbations per year (the subjects have not completed the COPD Assessment Test (CAT) [9, 10].

Information on patients' deaths was obtained from medical documentation (medical death certificates), from doctors in charge (mainly when family physician was changed) from the patients' family (they were asked to deliver all documentation if there was no contact with the patient).

Statistical analysis

Statistical calculations were made using the program Statistica 6.0. The values of quantitative variables were calculated as arithmetical mean and standard deviations. The groups were compared using analysis of variances. Fisher's Anova test was used, provided there was normal distribution of the variable studied and homogeneity of variance. Post hoc analysis for groups with different numbers of subjects were made with the help of Sheffe and Tukey tests. If the distribution of the variables was not normal, and variance was not homogenous — non-parametric Kruskal-Wallis test was applied (the comparison of two or more groups). Differences between the groups were regarded statistically significant with $p < 0.05$.

Comparisons between various groups of qualitative variables were performed using χ^2 Pearson's test or its modifications (Yates' and Fisher's tests) for smaller groups.

Results

Among 183 patients (98 men — 53.6% and 85 women — 46.4%) with COPD diagnosed in 2005, follow-up examination in 2011 was performed in 74 subjects (40.4%), and information about death of 43 patients (23.5%) between 2005–2011 was obtained. The remaining subjects (66 people — 36.1% of the initial group) have not undergone follow-up examination.

In the group of 74 patients examined in 2011, a mean of age was 65.8 ± 9.7 years and BMI — 27.2 ± 4.9 kg/m^2. Men constituted 51.4% of the group (38 individuals), whereas women 48.6% (36 individuals). 40 subjects (54.1%) lived in the city and 34 (45.9%) in the country.

Acceptable and repeatable spirometry tests (category A and B) were obtained in 62 subjects (83.8%). The results of spirometry were presented in Table 1.

The severity of bronchial obstruction assessed by spirometry in 2011 in the study group was as follows: mild ($FEV_1 \geq 80\%$ predicted) — 23 (31.1%), moderate ($FEV_1 \geq 50$ and $< 80\%$ predicted) — 24 (32.4%), severe ($FEV_1 \geq 30$ and $< 50\%$ predicted) — 12 (16.2%) and very severe ($FEV_1 < 30\%$ predicted) — 3 patients (4.1%), no data available — 12 persons (16.2%).

Category A included 25 patients — 33.8%, category B — 15 patients (20.3%), category C — 5

Table 1. Results of spirometry in 62 subjects out of 74 COPD patients performed in 2011

Tabela 1. Wyniki spirometrii w grupie 62 chorych spośród 74 badanych w 2011 roku

Variable	Pre-bronchodilator	Post-bronchodilator	p
FVC (L)	2.9 ± 0.9	2.9 ± 0.8	NS
FVC (% of predicted value)	92.9 ± 22.7	91.1 ± 22.8	NS
FEV_1 (L)	1.66 ± 0.7	1.68 ± 0.6	NS
FEV_1 (% of predicted value)	66.7 ± 21.5	66.9 ± 20.5	NS
FEV_1%FVC (%)	56.4 ± 10.4	56.5 ± 9.7	NS

NS — not significant

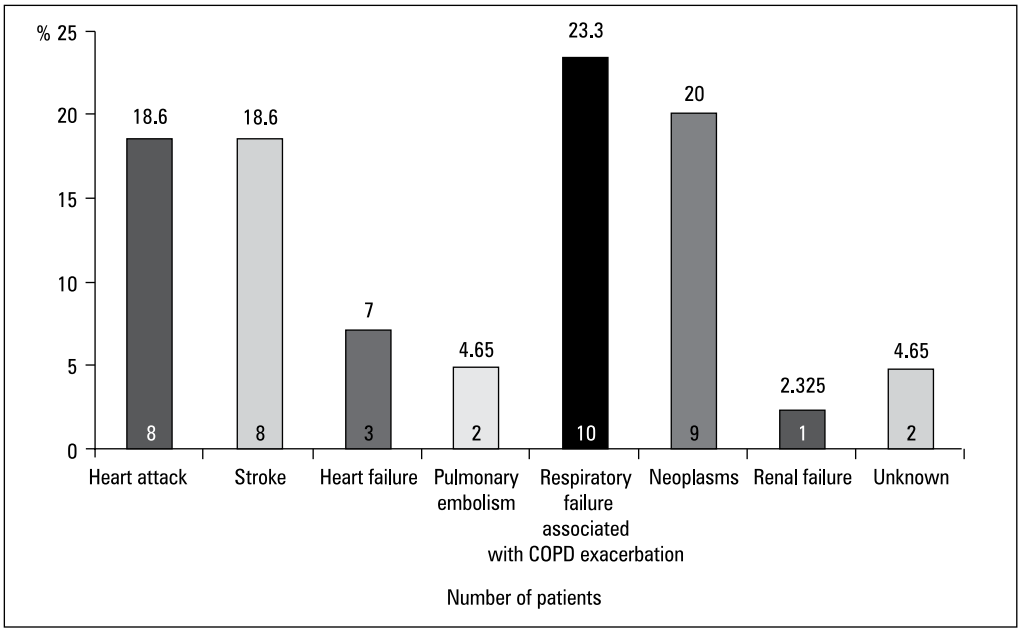

Figure 1. Causes of death in group of 43 subjects

Rycina 1. Przyczyny zgonów w badanej grupie chorych (43 badanych)

patients (6.7%), category D — 17 patients (23%) [9, 10]. In 12 subjects (16.2%), COPD category has not been established due to lack of correct spirometry.

Thirteen patients were hospitalised because of COPD exacerbations in the years 2005–2011 (from 1 to 6 times) (17.6%). The subjects who needed hospitalisation had lower FEV_1, compared to the patients who did not need it (50 ± 17.4% vs 71.5 ± 18.9% predicted respectively; $p = 0.007$). The study groups did not differ significantly in age, BMI, a number of pack-years, severity of dyspnoea in the MRC scale.

The most frequent causes of deaths in the study groups were cardiovascular diseases (in total 21 patients — 48.8% of the study group). Heart attack and stroke predominated, having caused 16 deaths (8 deaths per illness respectively). Respiratory insufficiency in the course of COPD exacerbation was the cause of death in 10 subjects (23.3%). Neoplastic diseases were responsible for 9 deaths (20.9%) (in 7 patients the cause of death was concomitant lung cancer, in 2 — prostate cancer). The remaining deaths were caused by exacerbation of renal insufficiency (1 patient — 2.325%) and undetermined causes (2 patients — 4.65%). The analysis of the causes of deaths was illustrated graphically in Figure 1.

Nearly 2/3 subjects died in hospital (28 people, 65.1%), the remaining died at home (15 individuals — 34.9%). Definitely more deaths occurred in men (34 patients — 79.1%), compared with women (9 patients — 20.9%). In the initial group of 2005, there were 98 male patients (53.6%) and 85 female (46.4%) ($p < 0.001$).

Taking into account the place of residence, the proportion of deaths was comparable among COPD patients living in the city and in the country [21 (48.8%) and 22 (51.2%) respectively]. The patients who died in hospital and home were compared in Table 2.

The factor that increased death risk among COPD patients was tobacco smoking. Among the patients deceased, nearly 90% smoked cigarettes (16 current smokers — 37.2% and 22 former smokers — 51.2%). Solely 5 deceased subjects never smoked cigarettes (11.6%). In 2005, in the group of 183 patients with diagnosed COPD, 77 subjects smoked cigarettes (42.1%), 58 subjects (31.7%) smoked cigarettes in the past and 48 persons (26.2%) never smoked cigarettes ($p = 0.0001$) [5].

More than 75% of the deceased (between 2006–2011), at the moment of diagnosis were at least 60 years of age, and at the moment of death, the proportion of patients ≥ 60 years of age exceeded 80%. The largest proportion of the deceased constituted the subjects between 70 and 79 years of age (Table 3).

In one third of the deceased, death occurred during the first two years after the first examination (16 subjects, 37.2%). More than half of

Table 2. Comparison of COPD patients died at hospital and at home [5]

Tabela 2. Porównanie chorych na POChP, którzy zmarli w szpitalu oraz w domu [5]

Variable	Hospital deaths 28 chorych/28 subjects (65.1%)	Home deaths 15 chorych/15 subjects (34.9%)	p
Age when died (lat/years)	69.6 ± 11	73.9 ± 8.3	NS
BMI (kg/m^2) in 2005	24.4 ± 4.2	23.6 ± 2.8	NS
FEV_1 post-bronchodilator in 2005 (% predicted)	55.6 ± 17.8	56.8 ± 23.1	NS
Packyears in 2005 (n)	40.9 ± 29.2	42.2 ± 24.3	NS
Males (n/% of males)	22 (64.7%)	12 (35.3%)	NS
Females (n/% of females)	6 (66.7%)	3 (33.3%)	NS
Town inhabitants (n/%)	12 (64.7%)	9 (35.3%)	NS
Village inhabitants (n/%)	16 (72.7%)	6 (27.3%)	NS

NS — not significant

Table 3. Age distribution and death ratio in COPD patients (comparison between 2005 and 2006–2011 years — diagnosis of COPD and time of death) [5]

Tabela 3. Analiza zgonów u chorych na POChP według kategorii wiekowych w chwili rozpoznania choroby (2005 r.) [5] oraz śmierci (2006–2011)

Age category (years)	COPD Diagnosis (2005) 43 subjects (% of group)	Time of death (2006–2011) 43 subjects (% of group)	p
40–49	3 (7%)	1 (2.3%)	NS
50–59	7 (16.3%)	7 (16.3%)	NS
60–69	8 (18.6%)	8 (18.6%)	NS
70–79	22 (51.1%)	21 (48.8%)	NS
≥ 80	3 (7%)	6 (14%)	NS

NS — not significant

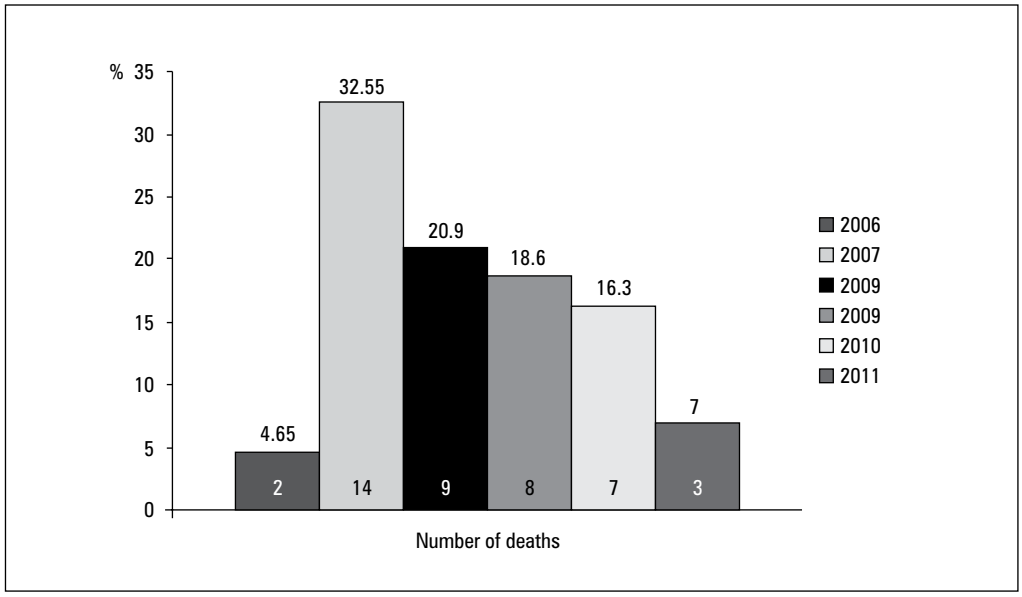

Figure 2. Percentage of death in consecutive years (2006–2011) in 43 subjects

Rycina 2. Odsetek zgonów w kolejnych latach (2006–2011) w grupie 43 chorych

deaths occurred during the first three years of follow-up (Fig. 2).

The number of deaths depending on their cause between 2006–2011 was illustrated in Figure 3.

Characteristics of the patients deceased during the consecutive years was presented in Table 4.

During the study, initial data of 2005 of the patients who were examined in 2011 (group 1 — 74 subjects) were compared with data of the subjects who died between 2006–2011 (group 2 — 43 subjects) and data of the patients who did not undergo follow-up examination (group 3 — 66 subjects). COPD patients who died were older, had more intensive dyspnoea in the MRC scale and lower FEV_1, one third of them had severe or very severe bronchial obstruction, and in 30% of them, COPD category D was diagnosed (Table 5) [5].

The evaluation of the group of the patients deceased depending on the cause of death (group 1 — deaths from COPD — 10 subjects; group 2 — deaths from cardiovascular diseases — 21 subjects, group 3 — deaths from neoplasms — 9 patients; 3 subjects were omitted — 2 with undetermined cause of death and one with renal insufficiency) revealed significantly lower FEV_1 and significantly higher dyspnoea score (MRC scale) in group 1. The patients who died from COPD were older, had lower BMI and a higher number of pack-years, compared to groups 2 and 3 (the differences were not statistically significant). Detailed data were included in Table 6 [5].

Economic status (subjectively assessed by patients in 2005) was comparable in the three groups (Table 7) [5].

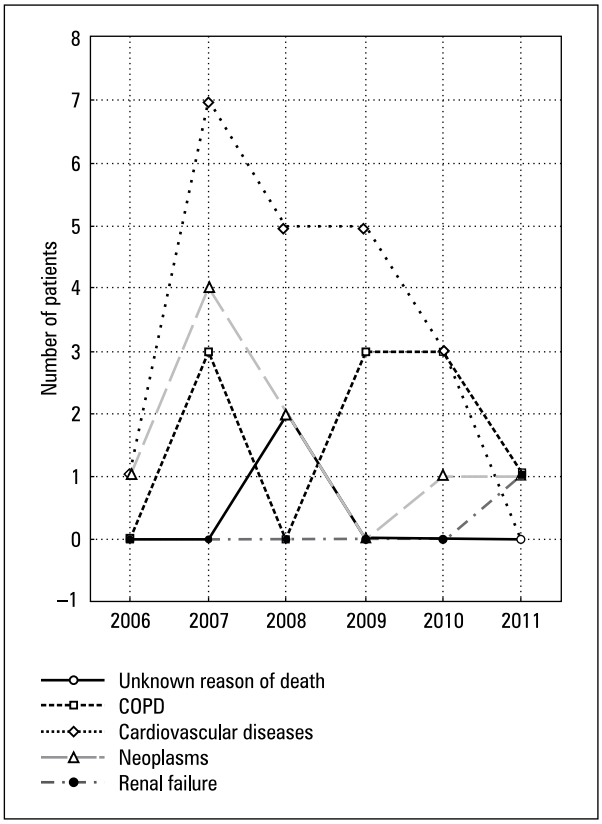

Figure 3. Number and causes of death in years 2006–2011

Rycina 3. Liczba zgonów w zależności od przyczyny w latach 2006–2011

Table 4. Comparison of baseline data (from 2005) age at the time of death in deceased patients according to year of death [5]

Tabela 4. Charakterystyka chorych zmarłych w latach 2006–2011 (wiek w chwili zgonu oraz pozostałe dane wyjściowe z 2005 r.) [5]

Variable (2005)*	2006 (n = 2)	2007 (n = 14)	2008 (n = 9)	2009 (n = 8)	2010 (n = 7)	2011 (n = 3)	p
Age at the time of death (years)	66 ± 8.5	68.7 ± 12.4	69.1 ± 5.7	74.2 ± 11.9	72.6 ± 9.3	80 ± 5.3	NS
*FEV_1 post bronchodilator (% of predicted value)	56.9 ± 5.4	57.8 ± 24.7	63.2 ± 16.4	42.3 ± 14.5	56.4 ± 16.4	66.2 ± 1.4	NS
*Packyears (n)	30.1 ± 13.6	30.4 ± 16.5	44.9 ± 28	56.4 ± 25.7	27.5 ± 20.1	77 ± 45.1	NS
*MRC dyspnea score (points)	3 ± 0	2.6 ± 1.3	2 ± 1	2.5 ± 1.2	2.4 ± 1.5	2 ± 1	NS

NS — not significant

Discussion

Chronic obstructive pulmonary disease (COPD) is characterised by a progressive impairment of ventilatory reserves, which leads to considerable limitations of effort tolerance, frequent exacerbations of the disease and respiratory insufficiency. One of the most frequent causes of death in COPD patients are disease exacerbations, during which respiratory insufficiency occurs or becomes more

Table 5. Comparison of baseline data (from 2005) in alive subjects in 2011 (group 1) and died in years 2006–2011 (group 2) and subjects lost to follow-up (group 3) [5]

Tabela 5. Porównaniu grup chorych (dane wyjściowe z 2005 r.) — pozostających przy życiu w 2011 roku (grupa 1), zmarłych w latach 2006-2011 (grupa 2) oraz chorych, których nie udało się zbadać ponownie (grupa 3) [5]

Variable (2005)	Group 1 (n = 74)	Group 2 (n = 43)	Group 3 (n = 66)	p
Age (years)	59.6 ± 9.7*	67.8 ± 9.9*#	60.2 ± 12.5#	* 0.001 # 0.003
BMI (kg/m^2)	26.1 ± 4.7	24.1 ± 3.8	25.6 ± 4.6	NS
FEV_1 post bronchodilator (% of predicted value)	71.2 ± 17.9*	56 ± 19.5*#	70.5 ± 19.7#	* 0.001 # 0.002
Severe and very severe airflow obstruction (n/%) (FEV_1 < 50% pred.)	11 (14.9%)*	14 (32.6%)*#	9 (13.6%)#	* 0.008 # 0.005
COPD category D (n/%)[xxx]	9 (12.2%)*	13 (30.2%)*#	8 (12.1%)#	* 0.008 # 0.002
Smokers (n/%)	54 (73%)	38 (88.4%)	43 (67.2%)	NS
Packyears (n)	35.2 ± 19.9	41.4 ± 27.1	29.2 ± 26.5	NS
MRC dyspnea score (points)	1.82 ± 0.99*	2.39 ± 1.19*#	1.5 ± 1.1#	* 0.01 # 0.007
MRC score ≥ 2 points (n/%)	39 (52.7%)	30 (69.8%)#	29 (43.9%)#	# 0.008

[xxx]COPD category was assessed by FEV_1 (% of predicted) and MRC score for baseline data from 2005 (CAT questionnaire was not performed and there was no data about number of COPD exacerbation during year); NS — not significant

Table 6. Comparison of baseline data (from 2005) in deceased patients according to reason of death: group 1 – COPD, group 2- cardiovascular diseases, group 3 — neoplasmatic diseases [5]

Tabela 6. Porównaniu grup chorych (dane wyjściowe z 2005 r.) — na podstawie przyczyny zgonu: grupa 1 — POChP, grupa 2 — choroby sercowo-naczyniowe, 3 — choroby nowotworowe [5]

Variable (2005)	Group 1 (n = 10)	Group 2 (n = 21)	Group 3 (n = 9)	p
Age in the time of death (years)	75.2 ± 13.1	70.7 ± 9.4	68.4 ± 8.9	NS
BMI (kg/m^2)	21.1 ± 3.1	24.5 ± 3.5	24.5 ± 2.6	NS
FEV_1 post bronchodilator (% of predicted value)	39.4 ± 16.3*	58.5 ± 18.2*#	68.3 ± 13.5#	* 0.04 # 0.005
Smokers (n/%)	9 (90%)	17 (80.9%)	9 (100%)	NS
Packyears (n)	41.4 ± 32.9	32.6 ± 16.6	38.4 ± 13.1	NS
MRC dyspnea score (points)	3.5 ± 0.97*	2.1 ± 1.0*#	1.7 ± 1.1#	* 0.01 # 0.002
Males (n/% of group)	9 (90%)	14 (66.7%)	8 (88.9%)	NS
Town inhabitants (n/% of group)	5 (50%)	10 (47.6%)	6 (66.7%)	NS

NS — not significant

intensive [11–14]. Death risk in COPD patients is significantly influenced by progression of the disease. Among patients with mild and moderate form of the disease, who have been observed even for 14.5 years since diagnosis, cardiac diseases and neoplasms were responsible for 55% of deaths [15]. In another study, the risk of premature death in patients with severe or moderate form of the disease was 2.7 and 1.6 respectively [16].

COPD exacerbations were the second most frequent cause of deaths in the study group. Nearly a quarter of deaths in COPD patients was related to respiratory insufficiency in the course of disease exacerbation.

Connors et al. [11] were evaluating 1,016 patients admitted to five hospitals due to COPD exacerbation every 6 months. 11% of the subjects died during hospitalisation. 20%, 33%, 43% and

Table 7. Financial status — baseline data (from 2005) in alive subjects in 2011 (group 1) and died in years 2006—2011 (group 2) and lost subjects (group 3) [5]

Tabela 7. Status ekonomiczny (dane wyjściowe z 2005 r.) – pozostających przy życiu w 2011 roku (grupa 1), zmarłych w latach 2006-2011 (grupa 2) oraz chorych nie zbadanych ponownie (grupa 3) [5]

Financial status (2005)	Group 1 (n = 74)	Group 2 (n = 43)	Group 3 (n = 66)	p
Good (% of group)	11 (14.9%)	5 (11.6%)	14 (21.2%)	NS
Satisfactory (% of gruop)	58 (78.4%)	36 (83.7%)	44 (66.7%)	NS
Bad (% of group)	5 (6.7%)	2 (4.7%)	8 (12.1%)	NS

NS — not significant

49% of the patients died 60 days, 180 days, one year and 2 years after hospitalisation respectively. The factors that significantly influenced an increased death risk in this group of patients were as follows: COPD severity, BMI, age, general condition of patients prior to exacerbation, PaO_2, cardiac insufficiency, serum albumin level and features of cor pulmonale. In the present study, age and COPD progression also impacted on death risk.

In the study by the Dutch authors [12], the group of 171 COPD patients hospitalised due to disease exacerbation has been observed. 8% of subjects died in hospital, and 23% during the year of follow-up. The factors that had a significantly negative impact on prognosis in their study group were the following: prolonged use of oral corticosteroids, higher $PaCO_2$ and older age (similarly as in the present paper).

Rubinsztajn and Chazan [13] have retrospectively analysed the group of 266 COPD patients who were admitted to hospital and died during hospitalisation (a mean of age 73 ± 8 years). The most frequent cause of death in COPD patients was as follows: exacerbations of the main disease (30%), pneumonia (25%), lung cancer (19%), ischaemic heart disease (7%) and cardiac insufficiency (5%). Definitely more often than in the present paper, the patients died from COPD exacerbations and pneumonia (55% vs 23.3%), which presumably was related to COPD severity. In both studies, the frequent cause of death was lung cancer (19% vs 16.3% in the present paper).

As many as 75% of COPD patients from the group of 215 people who had been treated with oxygen at home, died during hospitalisation. The main causes of death in these subjects were as follows: severe or chronic respiratory insufficiency (38%), cardiac insufficiency (13%), infections of the lower airways (11%), pulmonary embolism (10%), cardiac arrhythmia (8%) and lung cancer (7%) [14]. Definitely more frequently than in the present study, the subjects died from respiratory insufficiency and respiratory infections (in total 49% vs 23.5% in the present paper), which presumably was related to COPD severity (the patients were treated with oxygen at home).

Quintana et al. [17] prospectively assessed deaths of 2,487 COPD patients during hospitalisation or the first week after discharge from hospital. The examined subjects presented to the casualty department due to disease exacerbation. Basing on the results obtained, it was found that 5 factors significantly impacted on the growth of death risk in this group of patients (AUC:0.85) — age, dyspnoea severity (similarly as in the present study), oxygen therapy at home or history of non-invasive mechanical ventilation, the use of additional respiratory muscles or paradoxical breathing and altered consciousness.

In the study carried out by Anthonisen [15], the percentage of deaths in the group of 5887 patients with asymptomatic bronchial obstruction in the course of COPD was assessed. During a 14.5-year follow-up, 731 patients died (33% — from lung cancer, 22% — from cardiovascular diseases and 7.8% from other diseases of the respiratory system). In the present study, cardiovascular diseases and lung cancer were also one of the most frequent causes of deaths (48.8% and 16.3% respectively).

The British authors [18] evaluated the risk of death in COPD patients hospitalised due to disease exacerbation (meta-analysis of 37 studies concerning 189,772 subjects).

At the first stage of the study, "short-term" mortality [during hospitalisation and until 90 days after discharge from hospital (17 studies — 184,696 patients, including 13 studies into hospital mortality)]. In the whole group, 6,580 subjects died (3.6%). There were considerable differences in mortality between particular studies — from 1.8% to 20.4%. Prognostic factors that influenced the increase in the risk of short-term

mortality were the following: age, male sex, low BMI, cardiac insufficiency, renal insufficiency, confusion, oxygen therapy at home, oedema of the lower extremities, GOLD 4 COPD, cor pulmonale, acidosis and elevated troponin (age, male sex and advanced COPD were risk factors for death in the present study).

Long-term mortality (the period from 6 months up to 2 years after hospitalisation) was evaluated basing on the results of 8 studies (2300 patients). 712 deaths (31.0%) were found in this group, and the differences between the researches oscillated between 18.8 and 45.4%. Prognostic factors that impacted on the increase in the risk of long-term mortality were the following: age, low BMI, cardiac insufficiency, diabetes mellitus, ischaemic heart disease, neoplasms, FEV_1, oxygen therapy at home and PaO_2 at hospital admission (in the present study, the first and the third cause of death were cardiovascular diseases and neoplasms, the patients who died also had lower FEV_1).

Mortality rate among COPD patients who were admitted to intensive care units was evaluated basing on 12 studies (2,776 patients). In this group, 805 patients died (29.0%) (the results of particular studies differed considerably, mortality oscillated between 17.6% and 48.8%). Higher death risk in this group was associated with age, lower Glasgow Coma Scale score and pH.

Limitations of the study

Similarly as in the previous paper [5], predicted values adopted by the ECSC were used for spirometry. Currently, for the European population, it is recommended to use predicted values as indicated by Falaschetti [19]. Predicted values for FEV_1/FVC for people ≥ 65 years of age in the British authors' study are higher, compared with the norms adopted by the ECSC [8], which could be the reason for underdiagnosis of the disease in some patients examined in 2005.

We did not manage to examine or receive information about 66 patients (36.1% of the whole group) from the initial group of 183 patients — which adversely impacted on statistical analysis in the group examined in 2011. It is unknown how many subjects from this subgroup died between 2006–2011.

In the group of the patients deceased, there was no information about concomitant diseases, hospitalisations, number of exacerbations and smoking cessation after examinations performed in 2005.

COPD category for the data of 2005 was established basing on FEV_1 and the MRC scale (CAT questionnaire was not completed, data concerning the number of COPD exacerbations per year were not available).

Conclusions

Follow-up examination performed in COPD patients in a single family medicine practice institution 6 years after diagnosis of the disease revealed a high mortality in the study group (43 patients died — 23.5%).

More than 75% of all deaths were caused by cardiovascular diseases (mainly heart attack and stroke), COPD exacerbations and lung cancer.

The factors that influenced the growth of death risk in the study group were as follows: age, male sex, severity of dyspnoea (according to MRC scale) and more severe forms of the disease (severe and very severe bronchial obstruction/ COPD category D).

Conflicts of interest

The author declares no conflict of interest.

References

1. Rocznik demograficzny 2010, Główny Urząd Statystyczny 2011.
2. Murray CLJ, Lopez AD. Alternative projection of mortality and disability by cause 1990-2020: global burden of disease study. Lancet 1997; 394: 1498–1504.
3. Lozano R, Naghavi M, Foreman K et al. Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet 2012; 380: 2095–2128. doi: 10.1016/S0140-6736(12)61728-0.
4. López-Campos JL, Ruiz-Ramos M, Soriano JB. Mortality trends in chronic obstructive pulmonary disease in Europe, 1994-2010: a joinpoint regression analysis. Lancet Respir Med 2014; 2: 54–62. doi: 10.1016/S2213-2600(13)70232-7.
5. Bednarek M, Maciejewski J, Wozniak M, Kuca P, Zielinski J. Prevalence, severity and underdiagnosis of COPD in the primary care setting. Thorax 2008; 63: 402–407. doi: 10.1136/thx.2007.085456.
6. Miller MR, Hankinson J, Brusasco V et al. Standardisation of spirometry. Eur Respir J 2005; 26: 319–338.
7. Global Strategy for the Diagnosis, Management and Prevention of COPD, Global Initiative for Chronic Obstructive Lung Disease (GOLD) 2006. Available from: http://www.goldcopd.org/.
8. Quanjer PH, Tammeling GJ, Cotes JE, Pedersen OF, Peslin R, Yernault JC. Lung volumes and forced ventilatory flows. Report Working Party Standardization of Lung Function Tests, European Community for Steel and Coal. Official Statement of the European Respiratory Society. Eur Respir J Suppl 1993; 16: 5–40.
9. Górecka D, Jassem E, Pierzchała W, Śliwiński P. Zalecenia Polskiego Towarzystwa Chorób Płuc dotyczące rozpoznawania i leczenia przewlekłej obturacyjnej choroby płuc (POChP). Pneumonol Alergol Pol 2012; 80: 220–254.
10. Pierzchała W, Barczyk A, Górecka D, Śliwiński P, Zieliński J. Zalecenia Polskiego Towarzystwa Chorób Płuc rozpoznawania i leczenia przewlekłej obturacyjnej choroby płuc (POChP). Pneumonol Alergol Pol 2010; 78: 318–347.

11. Connors AF Jr, Dawson NV, Thomas C et al. Outcomes following acute exacerbation of severe chronic obstructive lung disease. The SUPPORT investigators (Study to Understand Prognoses and Preferences for Outcomes and Risks of Treatments). Am J Respir Crit Care Med 1996; 154: 959–967.
12. Groenewegen KH, Schols AM, Wouters EF. Mortality and mortality-related factors after hospitalization for acute exacerbation of COPD. Chest 2003; 124: 459–467.
13. Rubinsztajn R, Chazan R. Analiza przyczyn zgonów i chorób współistniejących u hospitalizowanych chorych na przewlekłą obturacyjną chorobę płuc. Pneumonol Alergol Pol 2011; 79: 343–346.
14. Zielinski J, MacNee W, Wedzicha J. Causes of death in patients with COPD and chronic respiratory failure. Monaldi Arch Chest Dis 1997; 52: 43–47.
15. Anthonisen NR, Skeans MA, Wise RA, Manfreda J, Kanner RE, Connett JE. The effects of a smoking cessation intervention on 14.5-year mortality: a randomized clinical trial. Ann Intern Med 2005; 142: 233–239.
16. Mannino DM, Buist AS, Petty TL, Enright PL, Redd SC. Lung function and mortality in the United States: data from the first national health and nutrition examination survey follow up study. Thorax 2003; 58: 388–393.
17. Quintana JM, Esteban C, Unzurrunzaga A et al. Mortality in patients with COPD exacerbations attending emergency departments. BMC Med 2014; 12: 66.
18. Singanayagam A, Schembri S, Chalmers JD. Predictors of mortality in hospitalized adults with acute exacerbation of chronic obstructive pulmonary disease. Ann Am Thorac Soc 2013; 10: 81–89.
19. Falaschetti E, Laiho J, Primatesta P, Purdon S. Prediction equations for normal and low lung function from the Health Survey for England. Eur Respir J 2004; 23: 456–463.