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Overview of Functional Capacity and Quality of Life of Chronic Obstructive Pulmonary Disease (COPD) Patients

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Abstract
Chronic Obstructive Pulmonary Disease (COPD) is one of the leading causes of morbidity and mortality worldwide, with a significant impact on patients' functional capacity and quality of life. This study aims to describe the functional capacity and quality of life of COPD patients at Prof. Dr. Chairuddin P. Lubis Hospital. This study is a descriptive observational study with a serial case design. The research subjects were stable COPD patients who met the inclusion and exclusion criteria, using a convenience sampling technique. Data collected included demographic characteristics, inhaled bronchodilator therapy, functional capacity measured using spirometry and the six-minute walking distance (6MWD) test, and quality of life assessed using mMRC and CAT scores. Statistical analysis was performed using descriptive methods. A total of 110 patients participated in the study; the majority were aged 60–69 years (69.6%) and male (78%). Mean FEV_1/FVC, FEV_1, FVC, and 6MWD scores were higher in the tiotropium group compared with the indacaterol/glycopyrronium group. The mean CAT score indicated slightly worse quality of life in the indacaterol/glycopyrronium group (10.9 vs. 9.9). The majority of patients had cardiovascular-related comorbidities (20.9%). Tiotropium therapy showed better results in functional capacity compared with indacaterol/glycopyrronium, while quality of life was influenced by COPD severity and comorbidities. A holistic management approach that includes comorbidity management and patient education is needed to improve prognosis and quality of life. Further research is needed to explore the relationship between therapy and clinical outcomes.

INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) is characterized by persistent respiratory symptoms and airflow limitation that is usually progressive and associated with a chronic inflammatory response in the airways and lungs to noxious particles or gases. Systemic consequences and comorbidities further contribute to the overall severity of COPD (Agustí & Hogg, 2019).

Chronic obstructive pulmonary disease is a serious respiratory disease with high morbidity and mortality rates (Zhang et al., 2021). By 2022, more than 3 million people died from COPD (Agrawal et al., 2019). This disease is characterized by limited airflow in the lungs and can arise due to long-term exposure to harmful substances, most often caused by cigarette smoke (Boers et al., 2023). Apart from smoking, several other risk factors also contribute to COPD, such as indoor and outdoor air pollution, genetic predisposition, occupational exposure to hazardous materials, and infections in childhood

and adulthood (Agrawal et al., 2019). COPD also continues to be a significant public health problem in Indonesia due to increasing life expectancy and rising exposure to risk factors, including high smoking prevalence, particularly among younger populations (Tamondong-Lachica et al., 2023).

COPD develops due to chronic inflammation of the airways, leading to thickening of airway walls, increased mucus production, and ultimately irreversible structural changes in the lungs (Solehati et al., 2019). This process involves oxidative stress, protease–antiprotease imbalance, inflammatory–anti-inflammatory imbalance, and apoptosis. These mechanisms do not occur independently but interact with each other, resulting in progressive and irreversible airway and lung damage (Yawn et al., 2021).

Chronic cough in COPD may be productive or non-productive (Sholihah et al., 2019). The diagnosis of COPD is confirmed by spirometry (FEV_1/FVC), and disease severity is further classified according to GOLD criteria. Symptom burden is assessed using the Modified British Medical Research Council (mMRC) questionnaire and the COPD Assessment Test (CAT). The mMRC scale evaluates dyspnea severity from 0 to 4, with higher scores indicating more severe breathlessness. The CAT provides a multidimensional assessment through eight items measuring the impact of COPD on daily life (Miravitlles et al., 2023; Singh et al., 2019). In 2023, GOLD further refined its classification approach by emphasizing exacerbation risk and combining categories C and D into group E to improve clinical relevance.

Based on the SUPPORT trial conducted by Arkhipov et al. (2017), which examined clinical characteristics of COPD patients across GOLD groups, patients in the GOLD D group had lower body mass index compared with those in group A. Patients in GOLD B and D were more likely to be active smokers than those in groups A and C. In addition, patients in groups B and D exhibited worse quality of life as measured by the St. George's Respiratory Questionnaire (SGRQ) compared with groups A and C (Lee et al., 2021; Vogelmeier et al., 2017).

Research on functional capacity and quality of life in COPD patients at Prof. Dr. Chairuddin P. Lubis Hospital remains limited. Therefore, this study aims to describe the functional capacity and quality of life of COPD patients at this hospital. The identified research gap lies in the lack of comprehensive, context-specific data regarding functional capacity and quality of life among COPD patients in this tertiary care setting in Indonesia. Although previous studies have explored similar outcomes in broader populations, local evidence remains insufficient, particularly considering potential variations in patient characteristics and clinical management practices.

The urgency of this study is driven by the high burden of COPD in Indonesia and the need for locally relevant data to support clinical decision-making and healthcare resource allocation. The novelty of this study lies in its comparison of functional capacity and quality of life between two bronchodilator therapy groups (tiotropium versus indacaterol/glycopyrronium) within a single Indonesian hospital setting. This study contributes by providing baseline data for future research and supporting evidence-based clinical decision-making in bronchodilator therapy selection. The objective is to describe

functional capacity and quality of life parameters in this patient population, while the expected benefit is to identify areas for improvement in COPD management and patient care at this institution.

METHOD

This research is a descriptive observational study that uses a case series design to see a picture of the functional capacity and quality of life of patients with Chronic Obstructive Pulmonary Disease (COPD) at Prof. Hospital. Dr. Chairuddin P. Lubis. The research was carried out at the Pulmonary Polyclinic at Prof. Hospital. Dr. Chairuddin P. Lubis. This research was carried out from September – October 2024. The research sample was part of the population that met the predetermined inclusion and exclusion criteria. Technique sampling is by non probability sampling namely by technique convenience sampling. The minimum sample size in this study was 63 subjects. Inclusion criteria were respondents with stable COPD who were diagnosed based on spirometry who were given inhaler therapy for at least 1 month and were willing to take part in a series of studies from start to finish and sign informed consent. Meanwhile, the exclusion criteria are: respondents with stable COPD aged > 70 years. The variables in this study are age, gender, education, body mass index, severity of smoking, pulmonary function, 6MWD, mMRC and CAT scales, comorbidities, and GOLD classification. The mMRC (modified Medical Research Council) scale is a simple instrument used to assess the degree of dyspnea based on the activities that trigger shortness of breath. This scale consists of five levels, ranging from score 0 to score 4. A score of 0 indicates dyspnea only during strenuous activity, while a score of 4 indicates breathlessness even during light activities such as dressing or being unable to leave the house due to breathlessness (Global Initiative for Chronic Obstructive Lung Disease, 2023; Celli & MacNee, 2004).

The mMRC scale is a validated, simple tool to measure the degree of baseline dyspnea and is included in the GOLD assessment framework. The CAT questionnaire provides a broader evaluation of health status, validated in multiple languages with good internal consistency (Jones et al., 2009). The 6-Minute Walk Test (6MWD) is a standardized method to evaluate functional exercise capacity in patients with chronic lung diseases, including COPD, and is recommended by both the ERS and ATS (Holland et al., 2014). Data analysis was carried out using statistical software. The description of the characteristics of research subjects is presented in tabulated and described form, where categorical data is displayed in percentage values while numerical data is in mean values and standard deviation. Research begins after making a proposal in 2024. Research starts from making a research proposal, examining the proposal, ethical clearance, data collection, data processing, data analysis and preparation of results reports and preparation of articles.

RESULTS AND DISCUSSION

A total of 110 COPD patients consisting of 54 patients receiving tiotropium and 56 patients receiving indacaterol + glycopyrronium participated in this study. Most of the

patients who became research samples were in the age range of 60 - 69 years and male. The study sample was dominated by patients with a high school education level. The BMI of COPD patients varied from underweight to obese 2 categories, but the majority were in the normal BMI range. The majority of the study sample belonged to the severe Brinkmann index degree and was categorized in the GOLD 3 classification. combination

Table 1. Demographic Characteristics

Characteristics	Group, n(%)	
	Tiotropium (n = 54)	**Indacaterol+ Glycopyrronium (n = 56)**
Age		
40-49 years	7(13)	2(3,6)
50-59 years	13(24,1)	9(16,1)
60-69 years	27(50)	39(69,6)
≥70 years	3(5,6)	6(10,7)
<40 years	4(7,4)	0(0)
Sex		
Male	38(70,4)	48(85,7)
Female	16(29,6)	8(14,3)
Education		
Elementary School	1(1,9)	5(8,9)
Middle School	5(9,3)	13(23,2)
High School	26(48,1)	23(41,1)
High Education/equivalent	20(37)	14(25)
Lain-lain	1(1,9)	0(0)
IMT		
Underweight	7(13)	6(10,7)
Normal	22(40,7)	16(28,6)
Overweight	12(22,2)	13(23,2)
Obese 1	12(22,2)	20(35,7)
Obese 2	1(1,9)	1(1,8)
Degree of Brinkmann		
No smoker	15(27,8)	14(25)
Light	7(13)	8(14,3)
Moderate	15(27,8)	8(14,3)
Heavy	17(31,5)	26(46,4)
Diagnosis		
Stable COPD Group A	3 (5.6)	2 (3.6)
Stable COPD Group B	37 (68.5)	25 (44.6)
Stable COPD Group E	14 (25.9)	29 (51.8)
GOLD		
Normal	3(5,6)	4(7,1)
I	9(16,7)	5(8,9)
II	9 (16.7)	10 (17.9)
III	23 (42.6)	17 (30.4)
IV	10 (18.5)	20 (35.7)

From the data found, it was found that COPD patients had several comorbid diseases and were mainly related to cardiovascular disease. COPD patients with CAD/ CHF were found to be 23 people (20.3%) of the total study sample.

Table 2. Comorbidities of COPD Patients

Comorbid Disease	Group, n(%)		Count
	Tiotropium (n = 54)	Indacaterol+ Glycopyrronium (n = 56)	
Asthma	1 (1.9)	0 (0)	1 (0.9)
Sequele TB	4 (7.4)	3(5.4)	7 (6.4)
Diabetes Mellitus	6 (11.1)	4(7.1)	10 (9.1)
Hypertension	8 (14.8)	14 (25)	22 (20)
CAD/ CHF	12 (22.2)	11 (19.6)	23 (20.9)
Bronchiectasis/ ILD	1 (1.9)	0 (0)	1 (0.9)
Dyslipidemia	1 (1.9)	1 (1.9)	2 (1.8)
BPH	1 (1.9)	3 (5.4)	4 (3.6)

Table 3. Symptom onset and degree of severity according to GOLD

Characteristics	Group, n(%)	
	Tiotropium (n = 54)	Indacaterol+ Glycopyrronium (n = 56)
mMRC, n(%)		
0	15(27,8	7(12,5)
1	10(18,5)	15(26,8)
2	15(27,8)	19(33,9)
3	12(22,2)	11(19,6)
4	2(3,7)	4(7,1)
CAT, mean(SD)	9,9±6,6	10,9±7,9
Diagnosis		
Stable COPD Group A	3 (5.6)	2 (3.6)
Stable COPD Group B	37 (68.5)	25 (44.6)
Stable COPD Group E	14 (25.9)	29 (51.8)
GOLD		
Normal	3(5,6)	4(7,1)
I	9(16,7)	5(8,9)
II	9 (16.7)	10 (17.9)
III	23 (42.6)	17 (30.4)
IV	10 (18.5)	20 (35.7)

The functional capacity of the study patients was assessed using spirometry and six minute walking test. Using the Kolmogorov-Smirnov normality test, It was found that FEV/FVC, FVC, and 6MWD data were normally distributed ($p>0.05$), while FEV1 data were not normally distributed ($p<0.05$). In general, the groups receiving tiotropium versus indacaterol / glycopyrronium had mean FEV1/FVC (65.3 vs 60.6), FEV1 (49.5 vs 44.3), FVC (64.5 vs 58.5), and 6MWD (242.4 vs 234.4) were higher.

Table 4. Spirometry results of COPD patients

Parameter	Group, mean(SD)	
	Tiotropium (n = 54)	**Indacaterol + Glycopyrronium (n = 56)**
FEV_1/FVC	65,3±14,0	60,6±12,8
FEV_1	49,5±22,6	44,3±21,1
FVC	64,5±20,1	58,5±20,9

Table 5. Results six minute walking test (6MWD) COPD patients

Parameter	Group, mean(SD)	
	Tiotropium (n = 54)	**Indacaterol + Glycopyrronium (n = 56)**
6MWD	242,4±71,6	234,4±63,54

The quality of life of the study patients was assessed based on mMRC and CAT. Testing the Kolmogorov-Smirnov normality test revealed that the CAT data was not ($p < 0.05$). There was a higher mean CAT score in the group receiving indacaterol/glycopyrronium (10.9) than tiotropium (9.9).

Table 6. mMRC and CAT results of COPD patients

Scale	Group	
	Tiotropium (n = 54)	**Indacaterol + Glycopyrronium (n = 56)**
mMRC, n(%)		
0	15(27,8)	7(12,5)
1	10(18,5)	15(26,8)
2	15(27,8)	19(33,9)
3	12(22,2)	11(19,6)
4	2(3,7)	4(7,1)
CAT, mean(SD)	9,9±6,6	10,9±7,9

The results showed that the majority of COPD patients were in the age range of 60–69 years, with a higher proportion of males (70.4% in the tiotropium group and 85.7% in the indacaterol/glycopyrronium group). This is consistent with previous epidemiological studies indicating that older age and male sex are more susceptible to COPD. Major risk factors, particularly smoking, which is more prevalent among men, contribute significantly to this distribution.

The majority of patients had an educational background at the senior high school level, indicating a moderate level of education. This may influence patients' understanding of COPD management and adherence to therapy, both of which are important factors in improving functional capacity and quality of life. Functional capacity was assessed using spirometry and the six-minute walking distance (6MWD) test. The results showed that the tiotropium group had higher mean values for FEV_1/FVC, FEV_1, FVC, and 6MWD compared with the indacaterol/glycopyrronium group.

Lower FEV_1 and FVC values in the indacaterol/glycopyrronium group may indicate a higher degree of airway obstruction. This is consistent with the greater proportion of patients classified as GOLD III–IV in this group (30.4% vs. 42.6% for GOLD III, and 35.7% vs. 18.5% for GOLD IV). The 6MWD reflects functional capacity, and the mean distance was lower in the indacaterol/glycopyrronium group (234.4 m) compared with

the tiotropium group (242.4 m), indicating differences in clinical response to bronchodilator therapy.

Quality of life was assessed using the mMRC and CAT scores. The results showed higher CAT scores in the indacaterol/glycopyrronium group (10.9) compared with the tiotropium group (9.9), indicating more severe symptoms and a greater impact on daily life. Most patients were classified at mMRC levels 1–3, with a higher distribution of mMRC levels 2 and 3 in the indacaterol/glycopyrronium group. This suggests a greater degree of dyspnea in this group, which may negatively affect physical activity and daily functioning.

Higher CAT scores in the indacaterol/glycopyrronium group may be associated with more severe COPD in this subgroup. The CAT score provides important clinical information to guide more intensive therapeutic approaches aimed at improving patients' quality of life. The most frequently observed comorbidity was cardiovascular disease (CAD/CHF), accounting for 20.9% of the total sample. This confirms the strong association between COPD and cardiovascular disease, which may worsen overall prognosis. Other comorbidities such as hypertension and diabetes mellitus were also common, emphasizing the importance of a holistic approach in COPD management.

Lee et al. reported improvements in lung function and quality of life in patients switched from tiotropium to indacaterol/glycopyrronium. Although FEV_1 improved significantly after combination therapy, no significant changes were observed in CAT or the Transition Dyspnea Index. However, patients who switched therapy still experienced changes in CAT scores (Lee et al., 2021; Vogelmeier et al., 2017). These findings are partially consistent with the present study, particularly regarding differences in CAT scores, although not all differences were statistically significant.

Buhl et al. demonstrated that quality of life did not differ significantly between patients receiving tiotropium/olodaterol and those receiving indacaterol/glycopyrronium. In addition, although the indacaterol/glycopyrronium group showed significantly better pre-dose FEV_1 and FVC values compared with the tiotropium/olodaterol group, no significant differences were observed in post-dose measurements (Buhl et al., 2015). Kaplan et al. also reported increased CAT scores in the indacaterol/glycopyrronium group compared with tiotropium at week 16, while improvements in lung function varied across GOLD stages (Kaplan et al., 2019). These findings are generally consistent with the present study in terms of CAT score differences but less consistent regarding spirometric outcomes.

Several factors may explain these discrepancies. The majority of patients in this study were elderly (60–69 years) and had normal BMI. Advanced age and low BMI are known to be associated with reduced lung function and increased dyspnea severity (Hashimoto et al., 2016; Lim et al., 2017). In addition, differences in study design — cross-sectional in this study versus cohort designs in previous studies — may also contribute to variations in results.

Previous studies have shown that dual bronchodilator therapy with indacaterol and glycopyrronium provides superior bronchodilation, improved quality of life, and reduced

exacerbation rates compared with monotherapy. In a large trial, indacaterol–glycopyrronium significantly reduced annual COPD exacerbations compared with salmeterol–fluticasone (Wedzicha et al., 2016). Similarly, tiotropium has been shown to improve lung function and reduce dyspnea, although its effects may be less pronounced than LABA/LAMA combinations (Maltais et al., 2010; Global Initiative for Chronic Obstructive Lung Disease, 2023).

Recent evidence further supports the superiority of dual bronchodilator therapy over monotherapy in stable COPD management. The GOLD 2024 report recommends LABA/LAMA combinations for patients with persistent symptoms or frequent exacerbations due to their synergistic bronchodilatory effects and lower risk of pneumonia compared with ICS-based regimens (Global Initiative for Chronic Obstructive Lung Disease, 2024). Wedzicha et al. demonstrated that indacaterol–glycopyrronium significantly reduced moderate-to-severe exacerbations compared with salmeterol–fluticasone, along with improved lung function and fewer adverse events (Wedzicha et al., 2016). Additionally, the BEACON study confirmed that the fixed-dose combination of indacaterol and glycopyrronium (QVA149) is as effective and safe as its free combination components (Vogelmeier et al., 2013). Symptom assessment tools such as CAT and mMRC remain essential for guiding treatment decisions and tailoring therapy to individual patient needs (Miravitlles et al., 2011).

This study has several limitations. First, the relatively small sample size of 110 participants divided into two treatment groups (tiotropium and indacaterol/glycopyrronium) may limit generalizability. Second, the study included only stable COPD patients and was conducted over a short observation period without long-term follow-up or exacerbation tracking. Third, important confounding factors such as inhaler technique, medication adherence, comorbidities, and environmental exposures were not controlled and may have influenced outcomes. Finally, the use of self-reported instruments such as mMRC and CAT may introduce subjective bias influenced by psychological or socio-cultural factors.

These limitations are consistent with previous findings reported in the GOLD 2023 report and supported by studies from Lee et al. (2021) and Mulyana (2019), which emphasize the complexity of assessing treatment response and symptom burden in COPD patients (Global Initiative for Chronic Obstructive Lung Disease, 2023; Lee et al., 2021; Mulyana, 2019).

CONCLUSION

Based on the research results, it was found that the functional capacity of the group receiving tiotropium had a higher mean FEV1, FVC, and FEV1/FVC compared to the indacaterol/glycopyrronium group, reflecting better lung conditions. The average distance traveled in the six-minute walking Distance (6MWD) was greater in the tiotropiumi group compared to indacaterol/glycopyrronium, indicating better functional capacity. mMRC and CAT scores showed more severe symptoms in the

indacaterol/glycopyrronium group compared to tiotropium. Higher levels of shortness of breath in the indacaterol/glycopyrronium group correlated with lower quality of life.

The findings support current evidence that dual bronchodilator therapy is more effective than monotherapy in improving clinical outcomes in COPD. This reinforces recommendations from recent guidelines advocating the use of LABA/LAMA combinations as a preferred initial or step-up treatment in symptomatic patients 17,30

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