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A Study of Relationship Between Asthma Control Test, Lung Function, & Hospitalization

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ABSTRACT

Introduction: The Asthma Control Test (ACT), developed in 2004, is a crucial tool for assessing asthma control. It facilitates discussions between patients and healthcare providers, guiding treatment decisions based on symptom severity. ACT evaluates symptoms over the past four weeks, while pulmonary function tests like forced expiratory volume in one second (FEV1) and peak expiratory flow (PEF) provide objective measures of airway function, offering complementary insights.

Method: This cross-sectional study was conducted at Prof. Chairuddin Panusunan Lubis USU Hospital. Asthma patients were recruited, their characteristics documented through interviews, and spirometry was performed to assess lung function.

Results: A significant proportion of patients had uncontrolled asthma based on ACT scores, which correlated with decreased lung function and higher risks of exacerbations. The study also explored characteristics of lung adenocarcinoma patients. Most were male (76.4%), heavy smokers (70.6%), and aged over 60 (52.9%). A majority (70.6%) were at Stage IVA, with pleural metastases being the most common. ALK mutations were detected in 5.8% of cases using immunohistochemistry.

Conclusion: Achieving optimal asthma control remains a priority to reduce exacerbation risks and improve outcomes. ACT is a practical, patient-centered tool for identifying uncontrolled asthma and guiding management strategies. The adenocarcinoma findings highlight the need for early detection and targeted therapies in lung cancer care. These results reinforce the value of combining patient-reported outcomes and objective tests in disease management.

Keywords

Asthma, Control, Test, Lung Function, Hospitalization.

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INTRODUCTION

The Asthma Control Test (ACT) is a standardized patient-reported outcome measure widely used to evaluate asthma control by assessing the impact of symptoms on daily life, including symptom frequency, reliance on rescue medications, and limitations in activities. Developed in 2004, the ACT serves as an essential tool for both patients and healthcare providers to facilitate discussions about asthma management and guide treatment decisions based on reported symptom severity and control levels.[1,2]

The development of the ACT was influenced by findings indicating the importance of reliable assessment tools in managing chronic conditions like asthma. Its simplicity and effectiveness have made it a cornerstone in asthma management strategies globally. One notable aspect of the ACT is its cultural adaptability, as it has been implemented across various countries and languages.[3,4]

The ACT has demonstrated fair to moderate agreement with physician assessments of asthma control, suggesting that while it serves as a useful screening tool, it should complement, rather than replace, comprehensive clinical evaluations. The tool's insights into patient-reported outcomes have proven valuable in monitoring asthma management and guiding therapeutic interventions, thus playing a significant role in disease management strategies.[2-5]

ACT serves as a pivotal instrument in evaluating the effectiveness of asthma management strategies. By requiring just a few minutes to complete, it provides healthcare providers with valuable insights into whether the current treatment plan is successful. Changes in ACT scores have been strongly correlated with other measures of asthma control, highlighting its role in maintaining a high quality of life for patients.[1-6] Recent advances in asthma treatment emphasize personalized care, incorporating innovations such as biologic drugs that target specific pathways in asthma pathogenesis. The Global Initiative for Asthma (GINA) guidelines advocate for a tailored approach, advising clinicians to consider stepping down treatment regimens once good symptom control is achieved.[7]

The Asthma Control Test and pulmonary function tests, such as forced expiratory volume in one second (FEV1) and peak expiratory flow (PEF), are both used to monitor asthma, but they measure different aspects of the disease. ACT is a patient-reported questionnaire that assesses symptoms and overall control over the past four weeks, whereas pulmonary function tests provide objective measures of airway function.[8] Studies generally show a weak to moderate correlation between ACT scores and lung function parameters, as the ACT primarily reflects symptoms and control rather than lung function metrics alone.

Combining ACT with lung function tests might offer a more comprehensive assessment of asthma control, particularly in clinical settings where objective airway function measures are important for treatment planning. There is a need for comprehensive evaluations of ACT scores and their relationships with various outcomes, such as lung function and healthcare utilization. This will not only enhance the clinical utility of the ACT but also provide deeper insights into patient management and treatment efficacy.[7,8]

METHOD

This analytical study uses a cross-sectional design. Asthma patients were recruited for the study, which was carried out at Prof. Chairuddin Panusunan Lubis USU Hospital. Following the documentation of the subject's characteristics and data from the interview, the patient underwent spirometry to obtain the results of the lung function test. Asthma control test scores interpreted to well-controlled, not well-controlled, and poorly controlled. Spirometry calculates an individual's air exhalation volume and rate.

The interpretation of spirometry data is dependent on two measurements, specifically FEV1 and FVC. FEV1 measures the amount of air that can be expelled in a single second after a prolonged intake, while FVC reflects the amount of air that can be exhaled after taking a deep breath and measures the size of the lungs (in liters). Each variable was displayed using univariate analysis. The Statistical Program for Social Sciences (SPSS) version 24.0 (IBM Corporation, Armonk, NY, USA) was used for all statistical analyses.

RESULTS

According to the study findings demographic (Table 1), from a total of 76 diagnosed asthma patient most were female (80.3%) and below 55 years old (60.5%), 50 was the average age. More than half samples graduated from senior high school with 23 samples (30.2%) graduating with bachelor's degrees. Only One samples (1.3%) is smoker in this study, this patient is still actively smoking.

Table 1. Demographic Characteristics

Characteristic	Total	
	n	%
Age		
< 55 years old	46	60.5
> 55 years old	30	39.5
Sex		
Male	15	19,7
Female	61	80.3
Education Status		
Uneducated/Unknown	10	13.1
Elementary School	2	2.6
Junior Highschool	9	11.8
Senior Highschool	32	42.1
University	23	30.2
Smoking Status		
Never Smoker	75	98.7
Smoker	1	1.3

This study found that 55 patients (72.3%) were not well-controlled with only 13 patients (55%) being Well-controlled (Table 2). The spirometry result (Table 3) shows the average FEV1 value is 55.47%, with 20 patients (26.3%) having >70% FEV1. Only 9 patient (11.9%) did not had restriction disease. Our result also shows that 17 patients (22.4%) had airflow limitation (FEV1/FVC<75%), stable asthma patients if well-controlled rarely show a decline in FEV1/FVC value.

From the healthcare utilization standpoint (Table 4), this study shows more than half patient (76%) only visits outpatient clinic 3 – 6 times in one year. Only 5 patient (6.5%) had visits outpatient clinic 10 – 12 times in one year. The average visits of all patient combine is 6 times in one year.

Table 2. Asthma Control Test Result

Asthma Control Test	Total	
	n	%
Well-Controlled	13	17.2
Not Well-Controlled	55	72.3
Poorly Controlled	8	10.5

Table 3. Spiromety Result

Pulmonary Function Test	Total	
	n	%
FEV1		
> 70 %	20	26.3
60 – 69 %	10	13.2
50 – 59 %	20	26.3
35 – 49 %	16	21.0
< 35 %	10	13.2
FVC		
> 80 %	9	11.9
60 – 80 %	23	30.2
45 – 60 %	28	36.9
< 45 %	16	21.0
FEV1/FVC		
> 75 %	59	77.6
< 75 %	17	22.4

The results (Table 5) show that respondents with poorly controlled ACT scores have a lower mean FEV1/KVP than respondents with not well-controlled and well- controlled ACT scores, so that the higher the controlled ACT score, the higher the.

Table 4. Healthcare Utilization

Healthcare Utilization (One Year)	Total	
	n	%
Outpatient Clinic Visitation	5	6,5
10 – 12 Visits	12	15,7
7 – 9 Visits	58	76,5
3 – 6 Visits	1	1,3
Inpatient Hopitalization		
At Least Once	5	6,5
Never	71	93,5

FEV1/KVP score. However, from the results of the statistical test p value = 0.255 > 0.05, so it can be concluded that there is no relationship between the FEV1/FVC value and the ACT score (not significant). It is evident (Table 5) that respondents with poorly controlled ACT scores have an average FVC of 52.88. The average FVC for respondents with well- controlled ACT scores was 58.46, while the average FVC for respondents with not well controlled ACT scores was 57.40. According to these findings, respondents with well and not well-controlled GINA scores have higher average FVCs than respondents with poorly controlled GINA scores. Findings indicated that respondents with poorly controlled ACT scores had shorter average visit durations than those with well and not well-controlled ACT scores; in other words, the longer a respondent's visit, the more controlled their ACT scores were (p value = 0,361).

Table 5. Asthma Control Test and Other Outcomes

	Asthma Control Test			
Outcome	Well P Value n (%)	Not Well Controlled n (%)	Poorly n (%)	p value
Lung Function Test (FEV1/FVC)				
Obstruction	1 (7.7)	13 (23.6)	3 (37.5)	
No Obstruction	12 (92.3)	42 (76.4)	5 (62.5)	0,255
Obstruction Degree (FEV1)				
Mild	5 (38.5)	14 (25.5)	1 (12.5)	
Moderate	0 (0)	9 (16.4)	1 (12.5)	
Moderate - Severe	5 (38.5)	10 (25.5)	1 (12.5)	
Severe	2 (15.4)	10 (18.2)	4 (50.0)	
Very Severe	1 (7.7)	8 (14.5)	1 (12.5)	
Mean ± SD	58 ± 17.5	56 ± 18.5	47 ± 18.2	
	Restriction Degree (FVC)			
No Restriction	3 (23.1)	6 (10.9)	0 (0)	
Mild	2 (15.4)	18 (32.7)	2 (25.0)	
Moderate	4 (30.8)	21 (38.2)	4 (50.0)	0,719
Severe	4 (30.8)	10 (18.2)	2 (25.0)	
Mean ± SD	58.5 ± 17.1	57 ± 16.4	53 ± 11.1	
	Outpatient Clinic Visitation			
10 – 12 visits	0 (0)	4 (7.3)	1 (12.5)	
7 – 9 visits	3 (23.1)	8 (14.5)	1 (12.5)	
3 – 6 visits	10 (76.9)	43 (78.2)	5 (62.5)	0,361
< 3 visits	0 (0)	0 (0)	1 (12.5)	
Mean ± SD	6.0 ± 1.6	5.6 ± 2.1	5.13 ± 2.6	

	Inpatient Hopitalization			
At least once	0 (0)	3 (7.7)	2 (5.9)	0,360
Never	3 (100)	36 (92.3)	32 (94.1)	

DISCUSSION

Achieving effective asthma control is the main objective of asthma management. In this study, we found 55 patient (72.3%) not well-controlled based on ACT. A study by Zeru TG et al. on asthma patient in developing country Ethiopia show worse ACT with 48.2% patient with poorly controlled asthma.9 Previous study in Kuala Lumpur showed only 6.4% of the patients were deemed to have good control of their asthma while asthma was not well-controlled in 25.6% and poorly controlled in 68%. However, the study is a retrospective study of patients with asthma exacerbations admitted to their hospital. In that study conclude that poor asthma control is associated with increased risk of exacerbations, impaired quality of life, increased health-care utilisation and reduced productivity.[10,11]

Global Iniative for Asthma (GINA) state a low FEV1 percent predicted patient at risk of asthma exacerbation, independent of symptom level, especially if FEV1 < 60%.[11] From this study 46 patient had FEV1 < 60% and only 30 patients had FEV1 > 60%. The above table shows that respondents with poorly controlled ACT scores have an average FEV1 of 47.00. The average FEV1 was 56.15 for respondents with not well-controlled ACT scores and 57.85 for respondents with well-controlled ACT scores. According to these findings, respondents with well and not well-controlled GINA scores have higher average FEV1 than respondents with poorly controlled ACT scores. These findings demonstrate that the FEV1 value decreases with decreasing GINA score altough the results of the statistical test p value = 0.374. Dijk et al's study There is substantial evidence that an improvement in lung function, especially FEV1, is correlated with an improvement in ACT score.11 This study shows that respondents' average visit in one year is 5.63 times, or roughly six visits. Respondents' visits ranged from two to twelve, with two being the smallest number. Findings indicated that respondents with poorly controlled ACT scores had shorter average visit durations than those with well and not well-controlled ACT scores; in other words, the more a respondent's visit, the more controlled their ACT scores were. A study from Padang, Indonesia reported there is a significant relationship between medication adherence and asthma control ($r=0.508$; $p<0.05$). Improving patient medication adherence has the potential to improve asthma control levels.12 Regular visit means regular monitoring of asthma, it is crucial for optimizing disease management and ensuring clinical stability. This includes the periodic review of the asthma action plan, which should be personalized to meet the needs of each patient. As asthma severity and control can change over time, such reviews play an essential role in adapting treatment strategies accordingly.[7,13]

The Asthma Control Test (ACT) has been found to inversely correlate with the risk and frequency of asthma exacerbations, with lower ACT scores often indicating a higher risk of exacerbations.14 According to our findings, 13 (100%) of the respondents with well-controlled ACT scores have never had an exacerbation. Eight (100%) of the respondents with poorly controlled ACT scores had never experienced an exacerbation, while fifty (90.9%) of the 55 (100%) respondents with well-controlled ACT scores had never experienced one. Our statistical test results that the p value is greater at 0.360.

While our study provides valuable insights into the relationship between asthma control test, pulmonary function test, and hospitalization, it is limited by a small sample size. This limitation reduces the statistical power and generalizability of our findings, potentially affecting the reliability of our conclusions. Future research should aim for larger, more diverse participant samples to strengthen the analytical significance and broaden the applicability of the results. Additionally, a multi-center approach or longitudinal design could enhance the robustness and scope of findings in future studies.

CONCLUSION

One of the most important objectives in asthma treatment is still reaching optimal asthma control. According to ACT scores, a significant proportion of patients in our study had poorly controlled asthma, which is in line

with findings in other populations that associate poorly controlled ACT scores with decreased lung function and increased exacerbation risks.

Improved control was linked to frequent clinic visits, medication adherence, and routine monitoring. Additionally, doctors should be aware that patients may express how they perceive their asthma symptoms in ways that are inconsistent with how their lungs function. To more accurately evaluate the state of asthma control, doctors must also pay attention to data other than ACT and FEV1.

DECLARATIONS

Ethics approval and consent to participate. Respiratory Medicine, Faculty of Medicine, Universitas Sumatera Utara.

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The Authors agree to publication in Journal of Society Medicine.

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The authors declare that there is no conflict of interest in this report.

AUTHORS' CONTRIBUTIONS

All authors significantly contribute to the work reported execution, acquisition of data, analysis, and interpretation, or in all these areas. Contribute to drafting, revising, or critically reviewing the article. Approved the final version to be published, agreed on the journal to be submitted, and agreed to be accountable for all aspects of the work.

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