Med. J. Cairo Univ., Vol. 93, No. 2, Accepted 12/3/2025
DOI: 10.22608/MJCU. 563-567, June 2025
www.medicaljournalofcairouniversity.net

Effect of Diabetes Control on Asthma and Effect of Asthma on Diabetes Control

ALAA SHALABY, M.D.*; AMR EL-MELIGY, M.D.**; RAEF H. EMAM, M.D.*;
AMIRA I. ALMELDIN, M.D.* and MOHAMMED S. SELEEM, M.Sc.*

The Departments of Chest Disease and General Medicine**, Faculty of Medicine, Cairo University*

Abstract

Background: Asthma, a chronic illness characterized by inflammation of the lungs' small airways, is a common illness that imposes a considerable burden globally.

Aim of Study: To assess the pattern pulmonary function in diabetic cases with asthma and the impact of asthma on diabetes control and the impact of diabetes on asthma control.

Patients and Methods: This cross-sectional randomized controlled trial on 130 cases of whom Group A constituted 50 asthmatic cases as a control. Group compared to 80 asthmatic cases with diabetes mellitus (DM) (group B).

Results: In group B: There was a significant inverse correlation between maximal expiratory flows at 75% (MEF75) and fasting blood sugar (FBS) and glycated hemoglobin (HbA1c) and between forced expiratory volume (FEV1) and postprandial blood sugar (PPBS). FEV1, FVC and MEF85 improved in control DM compared to uncontrolled DM, although the difference was insignificant.

Conclusion: Asthma can impair glycemic control in diabetes cases, particularly if it remains uncontrolled. Cases with type 2 diabetes exhibited significantly lower spirometric values negative predictor of follow-up lung function, causing the writers to infer that decreased lung volume and airflow limitations may be complications of type 2 diabetes.

Key Words: *Diabetes control – Asthma – Pulmonary function.*

Introduction

ASTHMA, a chronic illness characterized by inflammation of the lungs small airways, is a common illness that imposes a considerable burden globally **[1].**

Asthma impacts over 300 million individuals globally. Asthma is manageable, despite being a chronic illness. Asthma drugs are categorized into two primary classes: Controller medications and relief medications. Controller medications reduce inflammation or offer prolonged bronchodilation. Reliever medications have rapid bronchodilatory actions and are utilized to manage acute asthma symptoms. Despite the treat-ability of asthma, inadequate control of the illness has frequently been documented in clinical settings **[2].**

Diabetes is a prevalent co-morbid illness in adult cases with asthma. Previous population-based research indicated that the prevalence of co-morbid diabetes ranged from five percent to sixteen percent **[3].** In comparison to cases without diabetes, those with diabetes face an elevated possibility of other respiratory illnesses, including asthma, chronic obstructive pulmonary disease (COPD), pulmonary fibrosis and pneumonia **[4].**

Moreover, cases with concurrent asthma and diabetes had worse glycemic control, decreased quality-adjusted life expectancy **[5]** and an elevated possibility of asthmatic exacerbations and pneumococcal illness relative to cases with just diabetes or asthma. Multiple pieces of evidence indicate a close association between hyperglycemia and bronchial asthma. Acute asthma attacks are anticipated to elevate diabetogenic hormones such as glucocorticoids and catecholamines. Recent study has provided substantial evidence for the co-occurrence of insulin resistance and bronchial asthma. Pharmacologically, beta2-agonists and corticosteroids are the predominant therapies for asthma; theoretically, both may cause hyperglycemia **[5,6].**

Nonetheless, numerous current and past investigations have not proven hyperglycemic impacts of these drugs. The predominant method of administering anti-asthma drugs is via inhalation to their primary site of action, the pulmonary airways. As a

Correspondence to: Dr. Mohammed S. Seleem
E-Mail: Dr_Mohammad_Salah_Seleem.docx(29.33K)

result, only small quantities of these drugs are administered to the affected airways. The general circulation will include only tiny amounts of anti-asthma drugs, which facilitate their elimination by the appropriate excretory systems. Low concentrations and increased clearance of anti-asthma drugs are likely explanations for the diminished hyperglycemic impacts **[6-8].**

Aim of the Work:

This investigation aimed to assess the pulmonary function patterns in diabetic cases with asthma, as well as the effects of asthma on diabetes management and the effect of diabetes only asthma control.

Patients and Methods

This cross-section randomized controlled trial on 130 cases of whom Group A constituted 50 asthmatic cases as a control. Group compared to 80 asthmatic cases with diabetes mellitus (DM) (group B).

Inclusion criteria were eighteen years of age or older, had type-2 diabetes confirmed by a fasting plasma glucose level over 126 milligrams per deciliter during a screening visit, and had a physician's diagnosis of asthma.

Exclusion criteria: Tobacco use within 6-months of enrollment, current insulin users, systemic corticosteroid utilization within one-month of enrollment, and all participants in the trial granted consent, and the investigation protocol received approval from the reviewers.

Data collection:

We gathered full information on demographics, medical history, and lifestyle factors. Participants disclosed their medical history characteristic including age, height, weight, asthma or any allergies, family history of asthma, personal history of type-2 diabetes, and family history of diabetes among first-degree relatives. Additionally, clinical evaluations and samples have been collected for further analysis.

Ascertainment of asthma:

Throughout the gathered of information, all participants were specifically inquired regarding a physician's diagnosis of asthma and other chronic obstructive pulmonary illnesses (such as COPD, involving chronic bronchitis, emphysema, and bronchiectasis) as well as the date of diagnosis for these illnesses. Also asked about any family history of asthma.

Ascertainment of incident type-2 diabetes:

During the data collection, all participants were specifically asked about a diagnosed diabetes, especially type-2 diabetes, and the date of diagnosis of these illnesses. Also asked about any family history of asthma.

Results

Women represented 83.7% of group A compared to 60% in group B. There was a significant increase of FBS. PPBS and HAIC in group B when compared to group A, while FEV1, FEV1% predicted, FVC, FVC% predicted and MEF75 were significantly decreased in group B compared to group A.

Table (1): General characteristics of studied groups.

	Group A (Control)	Group B (N=80)	F	Significance
Age (years):				
Mean	54.70	56.40		
±S.D	12.50	13.10		
Sex:				
Worsen	43	54		
Men	7	26		
FBS:				
Mean	118.38	201.20	10.741	0.001
±S.D	75.882	137.52		
2h PP:				
Mean	170.20	227.31	19.686	0.000
±S.D	23.002	108.221		
Glycated Hb HbA1c (%):				
Mean	6.43	8.64	41.331	0.000
±S.D	0.385	1.421		
FEV1 (L/min):				
Mean	2.16	1.96	18.731	0.000
±S.D	0.788	0.348		
FEV1% predicted:				
Mean	72	67	8.33	0.03
±S.D	4.1	3.2		
FVC (L/min):				
Mean	2.44	2.20	17.341	0.000
±S.D	0.87	0.477		
FVC% predicted:				
Mean	77.8	69.7	9.42	0.001
±S.D	6.1	7.2		
MEF75% (L/min):				
Mean	2.649	2.26	11.841	0.000
±S.D	1.70	1.55		

Table (2): Correlation between PFT & fasting blood sugar (FBS) among cases with asthma and diabetes (group B).

	Number	Person correlation	Significance
FEV1	80	–0.133	0.317
FVC	80	–0.119	0.295
MEF75	80	–0.016	0.012*

*Correlation is significant at the 0.05 level.

A significant inverse correlation has been observed between MEF75 and FBS.

Table (3): Correlation between PFT and PPBS among cases with asthma and diabetes mellitus.

	Number	Person correlation	Significance
FEV1	80	–0.227	0.043*
FVC	80	–0.180	0.110
MEF75	80	–0.134	0.236

*Correlation is significant at the 0.05 level.

A significant inverse correlation has been observed between FEV1 and PPBS.

Table (4): Correlation between PFT and glycated HB (HbA1c) among group B.

	Number	Person correlation	Significance
FEV1	80	–0.013	0.911
FVC	80	–0.062	0.585
MEF75	80	–0.605	0.000*

*Correlation is significant at the 0.01 level.

A significant inverse correlation has been observed between MEF75 and HbA1c.

Table (5): Treatment with inhaled bronchodilators among groups studied.

Subgroup	Number on inhaled bronchodilators		Number without inhaled bronchodilators	
	No.	%	No.	%
Group 1 (n=50)	47	92.5	3	7.5
Group 2 (n=80)	78	97.5	2	2.5

*$p<0.05$.

Inhaled bronchodilators were used most often in asthmatic cases with DM.

Table (6): Treatment with inhaled bronchodilator Si (IBD) and risk of hyperglycemia.

Subgroup	Number on inhaled bronchodilators		Number without inhaled bronchodilators		Likelihood RATID
	No.	%	No.	%	
Group 1 (n=50)	47	92.5	3	7.5	4.87*
Group 2 (n=80)	78	97.5*	2	2.5	

*$p<0.05$.

Treatment with IBD was not associated with increased risk of hyperglycemia.

Table (7): Correlation between PFT and glycatedHb (HA 1C) among cases with asthma and diabetes in uncontrolled versus controlled cases (group B).

	Controlled DM (n=17)	Uncontrolled DM (n=63)	Person correlation	Significance
FEV1:				
Mean	2.03	2.01	–0.113	0.210
±S.D	0.78	0.81		
FVC:				
Mean	2.14	2.13	–0.119	0.215
±S.D	0.87	0.76		
MEF75:				
Mean	2.22	2.20	–0.016	0.088
±S.D	1.60	1.41		

Correlation is significant at the 0.05 level.

FEV1, FVC and MEF75 improved in controlled DM compared to uncontrolled DM although the difference was insignificant.

Discussion

In the present study, cases with diabetes and asthma has been demonstrated to be correlated with reduction in FEV1 and FVC.

This was in contrast to other reports by Taylor et al. *[9]* where it was reported that those cases may have normal spirometry.

Davis et al. *[10]* showed that the mean FEV1% and mean FVC% have been decreased in diabetics with asthma, and the duration of diabetes was significantly correlated with FEV1% exhibiting borderline associations with FVC% in diabetics. The reduction in FEV1 and FVC correlated with diabetes duration is attributed to pulmonary microangiopathy in diabetes, marked by thickened alveolar capillary walls, pulmonary arteriolar walls, and alveolar walls, alongside alveolar space narrowing, alveolar epithelium flattening. and interstitium expansion.

Moreover, there is substantial evidence linking obesity to the onset of asthma, in addition to its association with type II diabetes *[11]*. Diabetes and insulin resistance are correlated with reduced lung function. Consequently, rising asthma rates may result directly from peripheral tissue insulin resistance and compensatory hyperinsulinemia, which disrupt the anti-inflammatory properties of insulin and enhance bronchial reactivity by inhibiting pre-synaptic M2 muscarinic receptors *[12]*.

Chronic airflow limitation, unlike intermittent hypoxia. may influence insulin resistance indicated by the inverse correlation between forced expiratory volume in one second and postprandial blood glucose in asthmatics with type-2 diabetes (p=0.043). Also, there was an inverse association

between FEV1 & MEF75% and PPBS & HAIC in asthmatics with T2D.

This was consistent with other findings reported by Ahmed et al. ***[13]***, where an inverse relationship was found between FEV1 and blood sugar in T2D.

There was a significant association between increased severity of asthma between cases with concurrent asthma and diabetes. Cases with asthma were less prone to asthma-related hospitalizations and exacerbations compared to asthmatics with Type-2 diabetes, which might be attributed to exaggerated inflammatory response in such cases. This finding was confirmed in hyperglycemia, which might be correlated with an increased risk of airway inflammation, which has been stated in earlier investigations.

Suissa et al. ***[14]*** found that exposure to ICS has been related to a higher risk of developing diabetes in a large nested c4l-controlled investigation.

Lifestyle measures such as regular exercise might not always be practical for glycemic control in cases with asthma. They suggest a stepwise algorithm for managing steroid-induced diabetes, taking into account random or one to two-hour postprandial plasma glucose levels. The management algorithm for hyperglycemia is demonstrated in the use of insulin when necessary. A pre-mixed formulation may be initiated (with a long-acting to short-acting molar ratio of 70:30 or 50:50) based on glycemic levels, followed by capillary glucose monitoring. Cases with Type I Diabetes Mellitus utilizing continuous subcutaneous insulin infusion (CS11) pumps during short- term steroid therapy demonstrated advantages from data obtained by continuous glucose monitors (CGMS) for insulin dose titrations ***[15]***.

This aligns with earlier research by Park et al.[16] which indicated a significant association between metformin utilization and asthma-related outcomes in s with both diabetes and asthma. Poor asthma management has been related to worsening glycemic control in young cases with type-1 diabetes. Cases utilizing metfomin had a lower risk of experiencing asthma-related hospitalizations and exacerbations compared to those not using metformin. Our results verified that the management of diabetes and the anti-inflammatory properties of oral hypoglycemic agent should be related to a decreased possibility of airway inflammation, leading to a reduction in the exacerbation of allergic eosinophilic inflammation, thereby decreasing the airway inflammatory response and enhancing pulmonary function, as previously documented in earlier investigations.

Conclusion:

Asthma could adversely affect glucose control in diabetic cases, particularly if left uncontrolled. Cases with type-2 diabetes exhibited significantly reduced spirometry values compared to expected levels. Glycemic exposure has repeated been shown to be a strong negative predictor of follow-up lung function, causing the writers to conclude that decreased lung volume and airflow limitations may be complications associated with type 2 diabetes.

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تأثير علاج الربو الشعبى على السيطرة على مرضى السكرى وتأثير السيطرة على مرضى السكرى وعلى مرضى الربو الشعبى

خلفية: الربو هو مرض مزمن يتميز بالتهاب مجارى الهواء الصغيرة فى الرئتين، هو مرض شائع يفرض عبئاً كبيراً على مستوى العالم.

هدف: لتقييم نمط وظائف الرئة فى حالات مرضى السكرى المصابين بالربو وتأثير الربو على السيطرة على مرض السكرى وتأثير مرض السكرى على السيطرة على الربو.

المرضى والطرق: أجريت هذه التجربة العشوائية المقطعية على ١٣٠ حالة، شكلت المجموعة (أ) منها ٥٠ حالة ربوية كمجموعة تحكم، وتمت مقارنة المجموعة (ب) ب ٨٠ حالة ربوية مصابة بمرض السكرى .(DM)

نتائج: فى المجموعة ب: كان هناك ارتباط عكسي كبير بين التدفقات الزفيرية القصوى عند ٧٥٪ (MEF75) وسكر الدم الصائم (FBS) والهيموجلوبين السكرى (HbA1c) وبين حجم الزفير القسرى (FEV1) وسكر الدم بعد الوجبة (PPBS)، تحسن FEV1 وFVC و MEF85 فى مرض السكرى المسيطر مقارنة بمرض السكرى غير المسيطر على الرغم من أن الاختلاف كان ضئيلاً.

خاتمة: يمكن أن يضعف الربو التحكم في نسبة السكر في الدم في حالات مرض السكرى، وخاصة إذا ظل خارج نطاق السيطرة، أظهرت الحالات المصابة بمرض السكرى من النوع ٢ قيماً أقل بكثير لقياس التنفس، وهو ما يعد مؤشراً سلبياً لوظيفة الرئة المتابعة، مما دفع الكتاب إلى استنتاج أن انخفاض حجم الرئة وقيود تدفق الهواء قد تكون من مضاعفات مرض السكرى من النوع ٢.