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STUDY OF SPIROMETRIC CHANGES IN MICA MINE WORKERS WITH DIABETES MELLITUS

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ABSTRACT

This observational study explores spirometric changes in individuals diagnosed with Diabetes Mellitus (DM). Diabetes is a prevalent chronic condition with widespread systemic effects, and its impact on respiratory function remains a subject of growing interest. The research involves monitoring and analysing spirometric data, focusing on parameters such as forced vital capacity (FVC), forced expiratory volume in one second (FEV1), and peak expiratory flow rate (PEFR) among DM patients. The investigation aims to uncover potential correlations between diabetes and pulmonary function, shedding light on how metabolic factors associated with DM may influence respiratory health. By employing spirometry, a standard pulmonary function test, the study strives to identify patterns or deviations in lung function metrics specific to diabetic individuals. The findings may contribute valuable insights into the complex interplay between diabetes and respiratory health, informing both clinical understanding and potential interventions. This observational approach allows for a nuanced exploration of spirometric nuances in the context of diabetes, paving the way for a deeper comprehension of the multifaceted health implications associated with this prevalent metabolic disorder.

KEYWORDS: Diabetes mellitus, spirometry, Mica mining, Diabetic nephropathy.

INTRODUCTION

Diabetes mellitus, is a metabolic disorder causes elevation in blood glucose levels, intricately impacting crucial organs such as nerves, kidneys, blood vessels, eyes, and the heart.[1,2] As a multifaceted and systemic condition, diabetes necessitates meticulous examination to unravel its far-reaching implications.[3] In other words Diabetes mellitus is a metabolic endocrine disorder that impacts the human body through physical, psychological and social health.[4] Derailed insulin release from pancreatic-beta cells and insulin resistance causes hyperglycaemias, further affecting the metabolism of lipids, carbohydrates and proteins.[5,6] Globally more than 200 million people are suffering with this disorder with high rates of mortality and morbidity. Its prevalence in India is more, followed by China and USA and is statistics predict it may reach to 333 million by 2025.[4]

In general Diabetes is classified ad 2 types, in which first type is referred as genetically based disorder and later is termed as dietary related disorder which is common and occur in 85-95% of the cases worldwide. Diabetes induces various acute and chronic complications that include diabetic ketoacidosis, hyperosmolar nonketotic hyperglycemia, and lactic acidosis are few types of acute metabolic complications. Few studies revealed the presence of chronic complications like micro vascular (neuropathy, nephropathy and retinopathy) and macro vascular (cerebrovascular accident, cardiovascular disease and peripheral vascular disease).[5]

Urban and rural lifestyle pattern and environmental factors influence on the distribution of diabetes. Within the expansive realm of diabetes research, a notable gap exists in comprehending the relationship between lung

function and diabetes.[6] Varied findings have emerged from different studies, with some reporting normal lung functions in individuals with diabetes, while others highlight abnormal respiratory parameters.[7,8] The significance of elucidating this intricate association lies in the potential repercussions of a compromised pulmonary reserve.[9,10]

As such, the present study is meticulously crafted to delve into the impact of diabetes mellitus on lung functions. The rationale for this investigation extends beyond a mere exploration of physiological parameters. By conducting a comparative analysis with individuals without diabetes, the study aspires to contribute substantive insights into the intricate interplay between diabetes and respiratory health.[11,12] Understanding the implications of diabetes on lung functions is not merely an academic pursuit but carries profound clinical significance.[10] Such insights could pave the way for targeted interventions, preventive strategies, and a more holistic approach to diabetes management.[13,14,15] As we confront the escalating diabetes epidemic, such comprehensive investigations play a pivotal role in shaping effective strategies for prevention, early detection, and management of this pervasive metabolic disorder.[16]

The proposed study on the impact of diabetes on lung functions is not just an academic pursuit but a crucial step toward unravelling an intricate facet of this metabolic disorder. As we delve deeper into understanding the implications of diabetes, each revelation contributes to a more comprehensive and nuanced portrait of this global health challenge. It is through such collective efforts, informed by meticulous research and a commitment to addressing the complexities of diabetes, that we can hope to navigate the path toward effective prevention, early intervention, and improved management strategies. The journey to combat diabetes is a collaborative one, involving researchers, healthcare professionals, policymakers, and communities coming together to shape a healthier future for individuals affected by this pervasive condition.

MATERIALS AND METHODS

Study design

A study was undertaken within the outpatient division of the general medicine department at Narayana Medical College & Hospital (NMCH) in Nellore, Andhra Pradesh, India.

Period of study: This study was carried out between December 2019 to October 2021 for a total duration of 23 months

Inclusion criteria: Adults with type 2 diabetes mellitus and with history of working in mica industry with informed. Consent were included.

Exclusion criteria: Those who are not willing/interested, had one or combinations of the following were excluded 1.Smokers 2. Present or past history of respiratory diseases that might affect lung function such as asthma, COPD, tuberculosis, bronchiectasis, interstitial lung disease. 3. Individuals with current or recent upper respiratory or lower respiratory infection, that could pre-dispose to heightened airway reactivity. 4. History of ischemic heart disease in the past. 5. T2DM patients with macro vascular complications.

Sample size

Study subjects 60 type 2 diabetic adults working in mica industry, Control subject's 60 non diabetic adults working in mica industry.

Details of the study

This research involves the division of the study population into two distinct groups: Group A (case) and Group B (control). Group A comprises all patients aged over 18 diagnosed with type 2 diabetes mellitus (DM) who seek medical attention in both the in-patient and outpatient departments. To adhere to the World Health Organization's (WHO) diagnostic criteria for diabetes, these individuals exhibit symptoms of diabetes with a random blood sugar level equal to or exceeding 200mg/dl, fasting plasma glucose at or above 126mg/dl (7.0 mmol/l), 2-hour plasma glucose value after a 75g oral glucose tolerance test (OGTT) surpassing 200mg/dl (11.1mmol/l), or an HbA1c level exceeding 6.5%.

Concurrently, Group B, serving as the control, is composed of healthy individuals aged over 18 who meet the WHO diagnostic criteria for being non-diabetic. These criteria include the absence of diabetes symptoms coupled with random blood sugar levels below 200mg/dl, fasting plasma glucose below 126mg/dl (7.0 mmol/l), 2-hour plasma glucose value after a 75g OGTT under 200mg/dl (11.1mmol/l), or an HbA1c level below 6.5%. Participants included in this study were recruited from both in-patient and out-patient departments. Upon recruitment, individuals underwent a comprehensive medical interview and a thorough physical examination, which included fundoscopy. The selection criteria for participants with type 2 DM included non-smoking patients without a history of respiratory issues, who willingly provided informed consent for participation in the study. These selected individuals, along with the control group consisting of healthy, non-smoking individuals, then underwent pulmonary function testing.

The collected data, encompassing the results of the pulmonary function tests, were meticulously entered into a Microsoft Excel spreadsheet for further analysis. This systematic approach ensures the acquisition of comprehensive and accurate data, facilitating a robust examination of spirometric changes in patients with type 2 diabetes mellitus compared to healthy controls. The inclusion of both in-patient and out-patient participants

enhances the study's scope and ensures a diverse representation of the population under investigation. Overall, this methodology establishes a solid foundation for the research, fostering reliable insights into the impact of diabetes on pulmonary function.

Statistical analysis

Pulmonary function tests for both case (type 2 diabetes patients) and control groups were subjected to statistical scrutiny through Student's unpaired 't' test, enabling a robust comparison. To explore the correlation between the duration of illness in type 2 diabetes patients and their pulmonary function, the Mann Whitney U Test was aptly employed. The examination of the relationship between various Spirometric indices and the duration of diabetes involved the application of Pearson's correlation coefficient.

Furthermore, the analysis extended to exploring the correlation between lung function tests and microvascular complications, a facet investigated through the chi-square test. This comprehensive statistical analysis was conducted utilizing SPSS version 20, ensuring a sophisticated and reliable assessment of the collected data. By employing these statistical methods, the study aims to unveil nuanced insights into the association between type 2 diabetes, its duration, and pulmonary function, shedding light on potential correlations with microvascular complications.

RESULTS

A total of 60 cases and 60 controls, who met the criteria were included in this study. Among 60 cases, 24 had microvascular complications and 36 had no microvascular complications (Table-1,2,3). Six (25%) out of 24 patients with microvascular problems had normal pulmonary function, while 18 (75%) had a restrictive pattern. Pulmonary function of 22 (61.1%) of the 36 individuals without microvascular problems was normal, while 14 (38.9%) exhibited a restrictive pattern. In participants with microvascular problem, there was a significant variation noticed in pulmonary function (P value 0.006) (Table-3). In individuals with microvascular problems, restrictive pulmonary function was more prevalent.

In 60 cases, 23 presented with nephropathy and remaining 37 did not have nephropthic symptoms. Out of 23 nephropathy patients, 13 were (56.52 percent) exhibited a restricted pattern of pulmonary function, whereas 11 (29.73%) out of 37 individuals without nephropathy, presented with restricted pattern of pulmonary function. Patients with nephropathy had a more restrictive pulmonary function pattern, which was statistically significant (P value 0.039) (Table-3;4).

In 60 cases, 24 exhibited retinopathy and 36 did not show any retinopathy symptoms. Out of 24 individuals. 15 (62.5%) with retinopathy exhibited a restrictive pattern of pulmonary function. Nine (25 %) of the 36 individuals without retinopathy exhibited a restricted pattern of pulmonary function. Patients with retinopathy had more of restrictive pulmonary function pattern, which was proved statistically significant (P value 0.004) (Table-3).

In 60 cases, 10 had neuropathy and 50 did not any neuropathic symptoms. Nine (90%) of the 10 neuropathy patients had a restrictive pattern of pulmonary function. 15 (or 30%) of the 50 individuals without neuropathy exhibited a restrictive pattern of pulmonary function. Patients with neuropathy had more of restrictive pulmonary function pattern and statistical data reports significance (P value 0.001) (Table-3).

Table 1: Gender Distribution among cases and controls.

Gender	Cases (%)	Controls (%)	Chi Square	P. Value
Male	27(45)	32(53.3)	0.834	0.361
Female	33(55)	28(46.7)		

Since the Chi square P value is more than 0.05 difference in gender distribution is non significant among cases and controls.

Table 2: Age distribution among cases and controls.

AGE	CASES(%)	CONTROLS(%)	CHI SQUARE	P-VALUE
<40 years	9(26.7)	8(25)	0.147	0.929
41-60 years	35(58.3)	37(61.7)		
>60 years	16(15.0)	15(13.3)		

Table 3: Correlation between comorbidities and T2DM in subjects.

Complications	subjects	Normal PFT (%)	Restrictive Pattern (%)	Odd's Ratio	Chi Square	P-Value
Micro vascular	Absent	22(61.1)	14(38.9)	4.714	7.545	0.006
	Present					
Nephropathy	Absent	18 (75)	11(29.73)	3.072	4.242	0.039
	Present	10 (43.48)	13(56.52)			
Retinopathy	Absent	27(75)	9(25)	5.0	8.438	0.004

	Present	9(37.5)	15(62.5)			
Neuropathy	Absent	35(70)	15(30)	21.0	10.125	0.001
	Present	1(10)	9(90)			

Table 4: Comparison of Pulmonary function test in type 2 diabetes patients and normal subjects.

Subjects	Cases(%)	Control(%)	CHI SQUARE	P-VALUE
Normal	36(60)	50(83.33)	8.044	0.005
Restrictive Pattern	24(40)	10(16.67)		

DISCUSSION

This research endeavors to delve into the intricate and often overlooked relationship between Type 2 Diabetes Mellitus (T2DM) and pulmonary function, providing comprehensive insights into the impact of diabetes on the respiratory system. The lungs, constituting one of the largest microvascular beds in the human body, are susceptible to microcirculation alterations induced by diabetes, leading to potential end-organ damage.[17,18] Despite the well-documented impact of diabetes on various organs, the lungs tend to escape comprehensive scrutiny, especially when patients present with chest pain, diverting attention primarily to cardiac concerns. This observational study, conducted meticulously at a tertiary care teaching hospital, systematically analyzes a cohort of patients who meet specific inclusion and exclusion criteria, ensuring a rigorous examination of the intricate relationship between diabetes and lung function. Notably, the study identifies a statistically significant correlation between T2DM and alterations in lung function[6,12], thereby contributing to the growing body of knowledge in this underexplored domain. The demographic distribution of diabetic patients within the age range of 41-60 years accentuates the relevance of exploring pulmonary implications in this specific age group, shedding light on potential age-related nuances in the manifestation of respiratory complications associated with diabetes.[19] The study's rigorous methodology and focus on age and sex-matched controls add robustness to the findings. One intriguing finding is the prevalence of restrictive lung patterns in diabetic individuals, surpassing that of non-diabetic controls. This pattern, observed in 40% of diabetic cases, prompts contemplation on the subtlety of pulmonary complaints in diabetic patients and their potential delay in seeking medical attention for respiratory issues. The study provides valuable insights into the spectrum of pulmonary changes, ranging from mild to severe restrictive patterns, adding granularity to our understanding of the impact of diabetes on lung function.[6,12]

Further dissection of the correlation between diabetes duration and lung function reveals a negative correlation with Forced Vital Capacity (FVC) and Forced Expiratory Volume in 1 second (FEV1). The identification of the median duration for diabetics to manifest a restrictive lung pattern as 6 years adds a temporal dimension to our understanding of the evolution of pulmonary complications in diabetes. The exploration of microvascular complications associated with diabetes, such as nephropathy, retinopathy, and neuropathy, unveils additional layers to the intricate relationship with lung function.[17,20] Distinct correlations emerge, suggesting that lung involvement may precede the onset of these complications. Notably, neuropathy demonstrates the strongest association with restrictive lung disease, indicating potential shared pathophysiological mechanisms. This research aligns with global studies, substantiating the link between T2DM and altered pulmonary function. Varied outcomes in prior studies emphasize the complexity of this association, with some studies indicating a decline in pulmonary function with age in diabetics. The present study, by adding valuable insights and nuances, contributes to the evolving understanding of the interplay between T2DM and pulmonary function. In conclusion, this observational study goes beyond conventional examinations, providing a nuanced and comprehensive exploration of the relationship between T2DM and pulmonary function.[7,11] The findings underscore the importance of considering lung health in the comprehensive care of diabetic individuals, paving the way for future research avenues and potential interventions aimed at preserving pulmonary function in this population.[1,2] The meticulous methodology employed in this study sets a precedent for future research in this domain, emphasizing the need for continued investigation to unravel the intricacies of the diabetes-lung connection.

The investigation conducted in this study revealed a prevailing restrictive pattern of impaired lung function among patients diagnosed with diabetes mellitus. These findings align with those observed in larger-scale studies, highlighting the consistency of results across diverse populations. The significance of examining lung function in individuals with diabetes cannot be overstated, as compromised respiratory capacity may render these patients more susceptible to both acute and chronic pulmonary conditions.[21] Notably, the research underscores the progressive nature of pulmonary dysfunction with the duration of diabetes. As the timeframe of diabetes diagnosis lengthens, the impairment in lung function exacerbates, emphasizing the dynamic interplay between diabetes and respiratory health. This temporal dimension adds a crucial layer of understanding to the evolving landscape of pulmonary complications associated with diabetes. The study discerned a statistically significant association between impaired lung function and other indices of microvascular injury. This linkage suggests a potential

interconnection between pulmonary health and broader microvascular complications in diabetes. The intricate relationship identified in this research accentuates the need for a holistic approach to diabetes care, acknowledging the multifaceted impact of this metabolic disorder on various organ systems.[3] While the study provides valuable insights, it also underscores the necessity for further prospective research endeavours to validate and solidify these observations. Establishing impaired lung function as a potential marker for microvascular complications could have profound implications for clinical practice.[17] This prospective outlook is crucial in unravelling the intricate dynamics between diabetes and pulmonary health, paving the way for targeted interventions and enhanced patient care.

CONCLUSION

In conclusion, this observational study contributes to the growing body of evidence emphasizing the prevalence of a restrictive pattern of impaired lung function in diabetes patients. The implications extend beyond respiratory health, urging healthcare professionals to consider the broader spectrum of microvascular complications associated with diabetes. The call for prospective studies underscores the commitment to advancing our understanding of these complex relationships and, ultimately, enhancing the management and outcomes for individuals living with diabetes.

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