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Research Article

Aetiology of Diabetes Mellitus and Implications from a Prospective Single Centre Study in Chinese Patients

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Abstract

Background and Objective: Diabetes augments the vulnerability of patients to get affected with several other diseases. In the present study, a prospective cross sectional investigation at a tertiary care hospital in Jingzhou, China during February, 2016-October, 2016, evaluating aetiology of diabetes mellitus and its implications was conducted. **Materials and Methods:** The patients were classified into three classes: (1) Patients with a prior medical history of diabetes, (2) Patients with no specific reasons for diabetes and (3) Patients without diabetes. In this study, a total of 495 patients (321 females and 174 males) were admitted during present study tenure. Among these patients 256 fell into Class I, 65 patients come into Class II and 174 into Class 3. In around 64.8% patients diabetes was main cause for the hospital admissions. Patients suffering from diabetes mellitus or new occurrence of hyperglycemia were substantially elder than patients without diabetic mellitus. **Results:** The most general causes for hospitalizations in the study were bronchial asthma 51 (10.3%), cerebrovascular disease 75 (15.1%), hyperlipidemia 148 (29.8%) and coronary heart disease 221 (46%). **Conclusion:** In the current study, it was observed that the common most etiologies for hospitalization were bronchial asthma, cerebrovascular disease, hyperlipidemia and coronary heart disease. In lieu of the findings of the current study suggests that regular check-up must be conducted for diabetic people as it could augment the probability, which may prevent imminent diabetes derived complications, specifically in elderly patients.

Key words: Diabetes, epidemiology, hyperglycemia, asthma, cardiovascular disease

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Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Diabetes is a multifaceted, long-lasting disease needs constant care with promiscuous risk-decreasing approaches in addition to glycemic regulation. Diabetes generally precipitates as a result of insulin inadequacy or because of the lack of its action, which creates elevated glucose levels in the circulating blood¹. The burden of diabetes both type 1 as well as type 2 has been soaring at an alarming speed. Across the globe the incidence of diabetes in the people over 18 years of age has been raised from 4.7% in 1980 to 8.5% in 2014². Even, presently diabetes has been reaching epidemic position in developed as well as developing nations². As per the estimates of the WHO, almost 50% of all deaths ascribable to high blood glucose occur before the age of 70 years². Moreover, WHO anticipated that diabetes can be the 7th most common cause of mortality by the year 2030². Furthermore, it is anticipated that there will be around 67% rise in the incidence of diabetes in developing nations from 2010-2030^{3,4}.

At present China witnessing the world's largest diabetes epidemic and continuing to grow at a formidable pace⁵. Rapidly growing proportions of diabetes mellitus have been found in previous studies and the most recent research study found that China has surpassed the USA in terms of diabetes prevalence: As per to the recent data, in China around 11.6% of adults are having diabetes⁶. The Chinese diabetes population reached at around 114 million people-about a third of all people with diabetes across the globe⁶. The investigators of that study cautioned of the massive burden on the country's public healthcare and economic system.

Diabetes mellitus either directly or indirectly has severe implications for people individually and communities as well for healthcare services⁷. Healthcare policy makers are seriously concerned over the soaring incidence of diabetes and its significant impact on the application of healthcare services. Holistic healthcare policies and practice interventions can improve diabetes care and can facilitate primary detection and treatment of diabetes. To stop the advancement of the disease improvement in the use of health services is essential. Several hospitalizations caused by diabetes are mostly avoidable⁸. Improvement in the quality of primary care for diabetes has immediate positive impact on the prevention of the disease as shown by a decrease in avoidable diabetes-related hospital admissions⁹. These findings show the pressing need for the current research studies to explore the controlling and preventive measures for diabetes.

Previous studies on the hospital admissions on the populations with diabetes and without diabetes have showed that hospitalization rates of people suffering from diabetes are

numerous times more than the patients not having diabetes mellitus. Moreover, it is conceived from the studies that hospital stay duration of diabetic patients is much longer than the patients who are not having diabetes^{10,11}. A study from the Asian country, has witnessed that the main or secondary reason for the 40.6% of hospital administration in Kuwait are basically due to diabetes⁸. In most of the studies, the financial and healthcare implications were over predicted as the studies include all hospital-based patients with severe diabetes and associated complications its allied morbidity. Recently, the healthcare policy makers in China has acknowledged that diabetes and its complication have a huge economic and community burden on the nation, so it is high time to take initiatives to fight with the prevailing problem. However, to devised the approaches to fight any healthcare burden the epidemiological studies are a prerequisite thing. These studies can find the risk factors for increased hospital admissions and allied other problems and root causes. Diabetes, besides having its own healthcare complications it is also a key risk factor for cardiovascular and renal ailments^{7,9}. Although it is known that the epidemiological data could drive us in creating efficient policies, at present there is a paucity of data pertaining to diabetes¹². The present study was conducted a study to find the incidence of hospital admissions among the diabetic people in China and the allied factors. Thus, it is vital for general health that those patients with greater hospital admission rates are characterized, to aim preventive activities more effectually. The current study targets to evaluate the present incidence of diabetes mellitus and its etiology in hospitalized Chinese adults.

MATERIALS AND METHODS

The present study was a cross sectional investigation and it was performed at Jingzhou Hospital of Traditional Chinese Medicine in the People's Republic of China during February, 2016-October, 2016. All the participating subjects fitting with the study inclusion criteria with clinical medical settings were enrolled for their prospective incorporation in the study. The study tenure was precisely from any patient whose glucose was not checked on hospital admission, people who had no awareness about the tenure of diabetes mellitus, patients admitted for surgeries and patients for whom clinical care sheets were not available were omitted from the study. A uniform data collection sheet was employed to gather the data for the present study. General information collected was demography (containing age of the patient, sex, prior history of smoking) and data about the hospital stay tenure, the cause for hospital admission and fasting blood glucose or random

Table 1: Characteristic feature of hospitalized patients

Variable factors	Total n = 495 (%)	Prior history of diabetes n = 256 (51.7%)	New occurrence of hyperglycemia n = 65(13.1%)	Patients without diabetes n = 174 (35.1%)	p-value
Gender					
Female	321 (64.8)	171 (66.7)	44 (67.6)	72 (41.3)	0.001 ^a
Male	174 (35.1)	85 (33.2)	21 (32.0)	102 (58.6)	
Age groups					
20-29	44	5	4	19	0.010 ^b
30-39	73	33	11	23	
40-49	104	54	14	35	
50-59	133	87	8	31	
≥60	141	77	28	66	
Smoker	270	159	38	119	0.067
Non-smoker	225	97	27	55	
Pre-existing characteristic feature					
Bronchial asthma	51 (10.3%)	21	13	19	0.014 ^a
Cerebrovascular disease	75 (15.1%)	39	4	38	0.090 ^a
Hyperlipidemia	148 (29.8%)	97	12	49	0.000 ^a
Coronary heart disease	221 (46.0%)	99	36	68	0.001 ^a

a: Chi square test, b: One way ANOVA, $p \leq 0.05$ was considered statistically significant

blood glucose. Moreover, patients' history of bronchial asthma, cerebrovascular disease, hyperlipidemia and coronary heart disease were also gathered. In this study, patients were divided into three subgroups, (a) Patients with a prior clinical history of diabetes mellitus, (b) Patients unaware about diabetes mellitus or new hyperglycemia and (c) Patients with no diabetes.

The rationale for dividing the present study population into three subgroups was to evaluate the dissimilarity in terms of aetiology and diabetic mellitus regulation. Before collecting data and performing the entire study related activities, the study got the ethical committee approval for gathering data and doing all the activities pertaining to this study from the Ethical Board, Jingzhou Hospital of Traditional Chinese Medicine. Furthermore as directed by the ethical requirements formal written informed consents were received from the each patient for their prospective enrolment in this study. Patient information/data collection was entirely anonymous and it was safeguarded that any data that discloses patient identity was prevented. All the human data collection and protection was according to the guidelines of the Declaration of Helsinki.

Statistical analysis: In the present study, the data were collected and eventually the statistical analysis was done by SPSS version 15 (SPSS, Inc, Chicago USA). Means $\pm$ SD values were employed to show all continuous variables and the numbers and percentages for categorical variables and further one way analysis of variance (ANOVA) was used to compare between means. For variances between categorical variables, it was utilized chi-squared (χ^2) test. The $p \leq 0.05$ was measured as a significant value.

RESULTS

In this study, with the execution of the study protocol, a total of 495 patients show the eligibility criteria and the study enrolled those patients. Among 495 patients 256 (51.7%) were found to be have prior history of diabetes or diabetes was main or coexisting reason for the hospitalization. Around 13.1% patients were found to have new occurrence of hyperglycemia and 35.1% patients were found to be without diabetes. In the initial patient screening and enrolment around 14 patients were excluded from this study, because they were suffering from newly detected with type 1 diabetes mellitus and hospitalised. All the baselines demographic characteristics were presented in the Table 1.

In this study, on the whole it was observed that major chunk of the hospitalized patients were females (64.8%) and the quantity of hospitalizations increased with age-over half of the patients in the sample (55.3%) were aged 50 years and above. Further, no substantial alterations were observed between smoker and non-smokers based on the occurrence of disease control over the other clinical parameters. The people who have diabetes mellitus or newly diagnosed hyperglycemia were substantially older than the patients who did not. Moreover, the diabetic patients were probably had a prior history of hyperlipidemia, bronchial asthma or cerebrovascular disease etc. Diabetes was the most general cause for hospitalization among the patients with diabetes (Table 1). Among the diabetes patients, the most common coexisting reasons for hospital admissions were: Bronchial asthma, cerebrovascular disease, hyperlipidemia and coronary heart disease.

DISCUSSION

In the current study, it was evaluated that present prevalence of diabetes and its etiology among hospitalized Chinese patients. This study results found that the frequency of hospital admission is 2-3 times higher in diabetic patients than the patients without diabetes. These findings are in contrary higher than those that demonstrated in the other studies from several other countries such as United States (40-45%), United Arab Emirates¹³, Al-Ain (38%), Oman (42%)¹⁴, Saudi Arabia (31%)¹⁵ and Egypt (42%)¹⁶. The heterogeneous observations among all these studies could be due to the disparity in patient's age distribution among various studies. Moreover, it might be due to disparity in the study methodology, inclusion and exclusion criteria, sampling and statistical procedures. The incidence of diabetes in China is the highest in the Asian continent and at present China holds the highest diabetes burden of the world⁶. Indeed, World Health Organization and IDF have expressed their serious concern over the growing diabetic patients' burden of China^{5,17}.

Patients' age is a critical factor for the incidence of diabetes. From the present study findings, it was analyzed that the pace of diabetes incidence rises with the increase in the patients' age. Indeed, previous studies have also witnessed similar findings^{8,18}. Furthermore, the present study found that diabetes incidence was substantially greater among women than men, which is in line with an earlier study by Jerneld and Algreve¹⁹ from Sweden.

In present study, it was found that the common most reasons for the hospital admission in diabetic people were bronchial asthma, cerebrovascular disease, hyperlipidemia, coronary heart disease and other diabetes allied complications such as acute metabolic decompensation. These study findings are in accordance with a previous study¹². The primary reason for the hospital admission in the present study was diabetes mellitus. Among the coexisting clinical conditions for the hospital admissions, coronary heart disease was having major stake. In fact, previous literature suggests that diabetes mellitus coexistence with congestive heart failure is a critical risk factor for the morbidity and mortality²⁰. A previous study addressing this issue has witnessed that coronary heart disease was the common most root cause for augmented hospital admissions in South Asian diabetic patients. Another earlier investigation by Cook *et al.*²¹ has found that coronary heart failure was the prevailing reason for the hospital admissions in the patients who were suffering from diabetes.

Furthermore, hyperlipidemia and other allied clinical complications are generally occurring in coexisting conditions with diabetes or there are increased chances to prevail in coexistence of hyperlipidemia and diabetes mellitus. In the present study, it was found that hyperlipidemia was the second most common reason for the hospitalization of diabetic patients. In this context an earlier study also witnessed that hyperlipidemia was the common most coexisting clinical condition with diabetes²².

In the present study, cerebrovascular disease was the third most common reason for the hospitalizations. As diabetes can be associated with several other clinical conditions such as atherosclerosis and vascular complications, it eventually could affect the blood circulation in cerebrum. Therefore, there are ample of chances diabetes can causes anomaly in cerebrovascular health conditions. Indeed, a previous study has established that there is a close relation between diabetes and cerebrovascular disease²³.

The study witnessed that respiratory asthma was the fourth generally common reason for the hospitalizations. The diabetic patients are susceptible to suffer from respiratory congestion conditions such as pneumonia²⁴. An earlier study witnessed around 6-14% of pneumonia occurrence²⁵. Furthermore, adult patients were likely to be admitted in hospital three times higher with respiratory complications than the patients without diabetes²⁶. Eventually, the patients with the coexisting diabetes and respiratory complications have an increased probability of mortality and morbidity²⁷. There are several underlying causes for the increased susceptibility of diabetic patients to pneumonia. The probable reasons could be: Impaired lung function, immunological anomalies, hyperglycemia and other chronic clinical complications²⁴.

As such the present study is a pioneering effort in our hospital facility. Present study has provided the preliminary evidence for the future studies in this regard. Although, it is having several unique characteristic features, present study has its own limitations, such as a smaller number in the cohort. However, the patients cohort enrolled in this present study was a good demonstration of diverse Chinese people. Therefore, findings of the present study could be relatively comprehensive. Moreover, the information was gathered physically from patients' care sheets manually, because of lack of involvement of electronic equipment for the same. Due to the paucity of data the study did not include the tenure of diabetes mellitus and glycemic regulation in the study results. Further studies can be considered examining the similar study

queries with a larger patients sample size. Similarly, prospective interventional investigations can be an operational option to detect the real time idea of the Chinese ambience. By this modality the target of upgrading in the diabetic mellitus control for the Chinese people could be attained.

CONCLUSION

In summary, it was found that the general aetiologies for the increased hospital admission were due to coronary heart disease, cerebrovascular disease, hyperlipidemia and bronchial asthma. In lieu of observations of the present study, it is suggestible that frequent diagnosis can be offered for diabetic patient. Through this way it can augment the probability of preventing diabetes and its allied clinical complications. It would be especially helpful in elderly people.

SIGNIFICANCE STATEMENT

This study discovers the underlying implications of diabetes and its aetiology that can be beneficial for future studies and public policy making of that geographical area. This study will help the researcher to uncover the critical areas of improvement to make the diabetes management easy, that many researchers were not able to explore. Thus a new finding may be arrived at.

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