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Original Article

A Study to Assess the Clinicopathological Spectrum of Acute Complications of Diabetes Mellitus in Relation to Hypertension

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Abstract

Introduction: The prevalence of diabetes mellitus has been dramatically increasing worldwide, making it an extremely costly chronic disease, both in terms of patient morbidity and health-care expenditure. As many non-communicable diseases have similar pathophysiologic mechanisms, so the clinicopathological spectrum and incidences of complications may be expected to be different from that observed in the general population. However, not many studies are available in this regard. Therefore, this study was conducted to assess the clinicopathological spectrum of the acute complications of diabetes mellitus in relation to hypertension.

Materials and Methods: This cross-sectional, analytical study was conducted on patients admitted in the ICU with the acute complication of diabetes mellitus. One hundred patients aged more than 18 years were included in the study. Relevant medical history and investigations were recorded.

Results: The mean diastolic BP was significantly lower in hypertensive patients. More proportion of hypertensive patients had deranged creatinine.

Conclusion: From the present study, it can be effectively concluded that the epidemiological and clinic-pathological profile of the patients having acute complications of diabetes mellitus is significantly different in hypertensive patients than in the non-hypertensives. Further studies need to be done in this regard.

Key words: Complications, Creatinine, Diabetes mellitus, Diabetic ketoacidosis, Hypertension, Hypoglycemia

INTRODUCTION

Diabetes mellitus, a chronic metabolic non-communicable disease (NCD), has attained epidemic proportions worldwide. The prevalence of DM has been dramatically increasing worldwide, making it an extremely costly chronic disease, both in terms of patient morbidity and health-care expenditure. As of 2015, more than 415 million adults have diabetes mellitus, and this number is estimated to increase to 642 million by 2040. More than 95% of all adults with diabetes mellitus have type 2 diabetes mellitus (T2DM).[1] India is one of the epicenters of the global diabetes mellitus epidemic and has the second-highest number of people with the disease in the world (~69 million individuals as of 2015).[2]

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Acute complications include extreme levels of blood glucose, with accompanying symptoms and/or other laboratory abnormalities. The acute metabolic complications of diabetes consist of diabetic ketoacidosis (DKA), hyperosmolar non-ketotic coma (HNC), lactic acidosis (LA), and hypoglycemia.[3] In general, these states are reversible and but if not treated, can lead to death. Hospitalizations for acute metabolic decompensation are

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associated with significant morbidity and mortality, and they are considered preventable with adequate ambulatory care. Severe glucose disturbances are not the only acute DM related events that lead to hospitalization. It has been demonstrated that people with DM have a greater risk of developing infectious diseases.[4] Not only does DM confer a >2-fold risk of being hospitalized for infection, the risk ratio for death from infection is almost double for people with DM compared to people without DM.[5]

Coexisting diseases precipitate DKA and DKA precipitates coexisting disease. Most often, patients with DKA have an infectious disease and signs of infection should be vigorously sought for and treatment should be instituted as appropriate. Other prominent comorbidities include cardiovascular events (myocardial infarction, stroke, thrombophlebitis, and pulmonary embolism), acute gastrointestinal disorders, and a variety of intoxications.[6]

The inter-relationship of diabetes and various other NCDs has been the least studied. As many NCDs have similar pathophysiologic mechanisms, so the clinicopathological spectrum and incidences of complications may be expected to be different from that observed in the general population. However, not many studies are available in this regard.

Therefore, this study was conducted to assess the clinicopathological spectrum of the acute complications of diabetes mellitus in relation to hypertension.

MATERIALS AND METHODS

This cross-sectional, analytical, observational study was conducted after approval from the Institutional Ethics Committee. Patients more than 18 years of age, presenting with acute complications of diabetes mellitus Type II (DKA, HNC, LA, or hypoglycemia), admitted in the emergency department or ICU and who consented to participate were included in the study. Pregnant females and any patient not consenting to participate in the study were excluded from the study. A total of 100 patients were included in the study.

Written informed consent was obtained from all the patients. Detailed medical history, including additional comorbidities, was recorded. A physical examination was done. Routine hematological and biochemical investigations were carried out. The normal ranges considered for investigations are as follows:

1. Hemoglobin: More than 12 g/dL
2. Creatinine: 0.6–1.2 mg/dL
3. Fasting blood sugar: 100–125 mg/dL
4. Post Prandial blood sugar: <140 mg/dL.

Statistical Analysis

The descriptive and analytical statistics were done. All the data were analyzed using statistical software. For descriptive stats: Results were expressed as mean ± standard deviation and proportions. Comparisons between qualitative data were performed with the Chi-square test (Fisher's exact test when any cell value was <5). For quantitative data, Student's *t*-test was used. $P < 0.05$ was considered to be "Statistically Significant."

RESULTS

The prevalence of hypertensives amongst patients with acute complications of diabetes mellitus was 28%.

The acute complications of diabetes mellitus were more prevalent in the females in non-hypertensive patients and in males in hypertensive patients [Table 1]. The mean age was more in the hypertensives (63.82 years) compared to non-hypertensives (51.93 years).

The distribution of the clinical features is as per Table 2. No statistically significant differences were found.

On physical examination, the mean diastolic blood pressure was significantly lower in the non-hypertensive patients compared to hypertensives [Table 3].

Serum creatinine was deranged in 50% of the hypertensive patients compared to only 25% of the non-hypertensive patients and the difference was statistically significant [Table 4].

DISCUSSION

At present, there is a phase of epidemiologic transition, causing a shift in the disease epidemiology from the

Table 1: Demographics of the study group

Gender	Hypertensive		Non-hypertensive		*P*-value	Statistical significance
	n	%	*n*	%		
Males	15	53.6	35	48.6	0.656	Not significant
Females	13	46.4	37	51.4		
Mean age±SD (in years)	63.82±7.87		51.93±13.30		<0.0001	Significant

Table 2: Distribution of the study group as per clinical features

Clinical feature	Hypertensive		Non-hypertensive		*P*-value	Statistical significance
	n	%	*n*	%		
Giddiness						
Present	22	78.6	43	59.7	0.076	Not significant
Absent	6	21.4	29	40.3		
Sweating						
Present	16	57.1	40	55.6	0.889	Not significant
Absent	12	42.9	32	44.4		
Palpitation						
Present	4	14.3	20	27.8	0.080	Not significant
Absent	24	85.7	52	72.2		
Vomiting						
Present	6	21.4	26	36.1	0.159	Not significant
Absent	22	78.6	46	63.9		
Tachycardia						
Present	9	32.1	29	40.3	0.452	Not significant
Absent	19	67.9	43	59.7		
Breathlessness						
Present	2	7.1	10	13.9	0.193	Not significant
Absent	26	92.9	62	86.1		

Table 3: Distribution of the study group as per the findings of physical examination

Parameter	Hypertensive		Non-hypertensive		*P*-value	Statistical significance
	Mean	SD	Mean	SD		
Temperature	97.32	1.33	96.99	1.49	0.301	Not significant
Respiratory rate	22.21	5.29	22.57	5.28	0.763	Not significant
Pulse	86.96	10.94	89.96	13.10	0.287	Not significant
Systolic BP	120.21	14.85	118.17	13.65	0.513	Not significant
Diastolic BP	79.07	6.92	76.28	5.84	0.044	Significant

Table 4: Distribution of the study group as per hematological and biochemical investigations

Parameter	Hypertensive		Non-hypertensive		*P*-value	Statistical significance
	n	%	*n*	%		
Anemia						
Present	13	46.4	33	45.8	0.957	Not significant
Absent	15	53.6	39	54.2		
Deranged creatinine						
Present	14	50.0	18	25.0	0.016	Significant
Absent	14	50.0	54	75.0		
Deranged fasting blood glucose						
Present	24	85.7	61	84.7	0.901	Not significant
Absent	4	14.3	11	15.3		
Deranged post lunch blood glucose						
Present	18	64.3	48	66.7	0.821	Not significant
Absent	10	35.7	24	33.3		

communicable to the NCD.[7] Ever since we have successfully controlled the communicable diseases, NCDs have been on the rise. The most common of these are diabetes and hypertension.

Hypertension and diabetes have an overlapping spectrum of clinicopathological features. In a study by Emdin *et al.*,[8] it was concluded that a 20 mm Hg higher SBP was associated with a 58% higher risk of new-onset diabetes, whereas a 10 mm Hg higher DBP was associated with a 52% higher risk of developing diabetes.

Hypertension and diabetes when occur together with central obesity and dyslipidemia, it is called as metabolic syndrome. Metabolic syndrome refers to a cluster of various interrelated cardiometabolic risk factors that promote the development of atherosclerotic cardiovascular disease and T2DM. The prevalence of metabolic syndrome in India is 11–41%.[9]

Not many studies have been conducted on these diseases due to the recent shift of focus. While there has been some degree of insight into the pathophysiology and long-term complications[10] of these diseases, the short-term or acute complications and their inter-relationship remain understudied.

Therefore, this study was conducted to assess the clinic-pathological features of hypertension and acute complications of diabetes mellitus.

In the present study, it was found that of the patients suffering from acute complications of diabetes, 28% were hypertensives.

Demographics

In the present study, the mean age was significantly more in the hypertensives (63.82 ± 7.87 years) compared to non-hypertensives (51.93 ± 13.30 years). It was also observed that females were affected more than males.

The prevalence of diabetes is more in females.[11] In the study by Duarte *et al.*,[12] it was observed that women have poor glycemic control than men. Thus, the prevalence of complications would be more in women.

The prevalence of hypertension is more in males. This was concluded in the survey by Choi *et al.*[13] and in the study by Cutler *et al.*[14] These differences are hypothesized to be due to both biological and behavioral factors.[15]

Accordingly were the findings in the present study.

Clinical Features

In the present study, no statistically significant difference was found in the symptoms of acute complications of diabetes, between the hypertensive patients and non-hypertensive patients.

It is plausible since the pathophysiology of diabetes and hypertension are inter-related, as is evidenced by the overlapping spectrum of presenting symptoms.[16] The common symptoms of hypertensive crisis at presentation are headache, chest pain, palpitations shortness of breath, vertigo, sweating, and nausea and vomiting.[17] However, no increase in the prevalence of presenting symptoms was found in patients with controlled hypertension.

Physical Examination

In the present study, the mean diastolic blood pressure was more in patients with hypertension as compared to patients without hypertension.

In acute complications of diabetes, especially DKA, there is dehydration from fluid loss secondary to glycosuria.[18] The systolic blood pressure reflects the pumping capacity of the heart, while the diastolic blood pressure is an indicator of the volume of blood and elasticity and recoil of blood vessels.[19] Therefore, diastolic blood pressure would be a better indicator of dehydration/fluid loss. The findings in the present study indicate some unknown mechanisms at play, preventing diastolic hypotension from an acute complication of diabetes in hypertensive patients.

Investigations

In the present study, the prevalence of deranged creatinine, indicating possible renal damage, was more in the hypertensive patients compared to non-hypertensives.

Hypertension and diabetes, both damage kidney in the long term. Hyperglycemia induces renal damage directly or through hemodynamic modifications and may involve the interplay of multiple cytokines.[20] Hypertension causes renal damage by its direct deleterious effects on kidney vasculature.[21] Therefore, it is plausible that the prevalence of deranged creatinine will be more in hypertensive patients.

Limitations

The study was limited by the ICU admission of patients of acute complications of diabetes mellitus. Therefore, the results may not be generalized.

CONCLUSION

From the present study, it can be effectively concluded that the epidemiological and clinic-pathological profile of the patients having acute complications of diabetes mellitus is significantly different in hypertensive patients than in the non-hypertensives, in some aspects. Acute complications of diabetes mellitus carry a grave consequence as they increase mortality and morbidity. Therefore, further studies need to be conducted to assess the profile of the patients having acute complications and to explore the effects of other comorbidities.

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