The Study of Correlation of Incidence, Severity of Renal, Cardiovascular Complications with Duration, Severity of Type 2 Diabetes Mellitus in a Tertiary Care Hospital

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

Original Research Article

ABSTRACT

Background: Type 2 Diabetes Mellitus (DM) is a disorder of the endocrine characterised by hyperglycaemia which results from variable degrees of insulin resistance and insulin deficiency.Chronic hyperglycaemia in diabetes may lead to multi organ damage resulting in renal, cardiovascular and other complications.In our study, we aim to look for correlation between the degree of glycemic control, duration of type 2 DM, incidence, severity of renal, cardiovascular complications in type 2 DM patients.

The objective of our study is to analyse the correlation between glycemic control and occurrence of cardiovascular, renal complications in type 2 DM patients.

Materials and Methods: 50 type 2 DM patients were selected from the Medicine outpatient of Saveetha Medical College and Hospital from January 2021 to March 2021.The study was explained and informed consent was obtained. Ethical committee clearance was obtained.The duration of the disease, regularity of treatment are recorded, serum HbA1c was done to evaluate the degree of glycemic control.Renal function tests like estimation of urea and creatinine are done to look for renal complications. Echocardiogram was done to evaluate the cardiac status of the patient.

Expected Outcome: We expect a direct correlation between the severity of uncontrolled hyperglycaemia, duration of the disease with the incidence of renal and cardiovascular complications.

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Results: 50 patients who were selected for the study having type 2 Diabetes Mellitus, were made into two groups - people with uncontrolled diabetes (HbA1c >7.5%) were more prone in developing renal and cardiac complications which were assessed by urea, creatinine, urine protein levels and ejection fraction (EF %) values.

The significant cut off values to cause complications were taken as for urea (>40mg/dl), creatinine (>1mg/dl), urine protein (+/++/+++), EF value(>50%) and the presence/absence of regional wall motion abnormality (RWMA) was noted.

It was also observed that longer age duration of the disease, more was the risk to develop cardiac complications than disease of shorter duration.

Hence a poor control of hyperglycaemia made the subject prone to renal and cardiovascular complications.

Conclusion: We arrive at a direct correlation between the severity and extent of uncontrolled hyperglycaemia with the incidence of severity and complications in the form of nephropathy and cardiac dysfunction.

1. INTRODUCTION

Diabetes Mellitus is a group of metabolic diseases characterized by chronic hyperglycemia resulting from defects in insulin secretion, insulin action, or both [1].

Several pathogenic processes are involved in the development of diabetes. These range from autoimmune destruction of the β-cells of the pancreas with consequent insulin deficiency to abnormalities that result in resistance to insulin action [2].

Diabetes is widely recognized as an emerging epidemic that has a cumulative impact on almost every country, age group, and economy across the world [3].

Diabetes Mellitus is one of the most common health problem characterised by hyperglycaemia, with type 2 being the most common one.The prevalence of diabetes mellitus worldwide has become an extended epidemic magnitudes and is expected to affect around 350 million people by the year of 2035 [4].

The complications of Diabetes Mellitus can be broadly categorised into microvascular and macrovascular. The microvascular complications of Diabetes Mellitus include Diabetic retinopathy, Diabetic nephropathy, Diabetic neuropathy to list a few. The macrovascular complications include coronary heart diseases, cardiomyopathy, arrhythmias, cerebrovascular disease, peripheral artery disease and even sudden death.

Finally, there are other complications of diabetes that cannot be included in the two aforementioned categories such as dental disease, reduced resistance to infections, and birth complications among women with gestational diabetes [5].

It is well established that obesity is a major contributory factor to insulin resistance and type 2 diabetes mellitus (T2DM) [6].

Diabetic nephropathy is one of the most dreaded complications of diabetes which can lead to chronic kidney disease and end stage renal failure globally.It is been estimated that more than 40% [7] of people with diabetes will develop chronic kidney disease (CKD).Cardiovascular and renal complications share many common risk factors such as high blood pressure, dyslipidemia and poor glycemic control.

Despite various improvements in preventive care for the patients with type 2 DM, cardiovascular disease remains as the most common cause of mortality among these patients. To address this, the European [8] guidelines recommend that echocardiography should be considered in the diagnostic work-up of patients with type 2 diabetes even in the absence of known cardiovascular disease.

2. MATERIALS AND METHODS

This was a cross sectional study of 50 patients done at the Medicine Out Patient of Saveetha Medical College and Hospital. The study was explained to the patients and informed consent was obtained. Ethical clearance committee consent was obtained. Basic demographic details were obtained, duration of

DM was asked and the following tests were done:

HbA1c, Urea, Creatinine, Urine protein and Echocardiogram.

From the echocardiogram, Ejection Fraction (EF) value was taken and presence/absence of any regional wall motion abnormality (RWMA) was noted.

3. RESULTS

3.1 Demographic Details

Out of the 50 patients selected for the study, 29 were male and 21 were female. The age group of the study ranged from 31 to 82 years. The mean age in the study group was 51 years.

3.2 Clinical Findings

Male=29
Female=21
Mean age= 51 years

Table 1. Distribution of number of subjects with the duration of Diabetes Mellitus (DM)

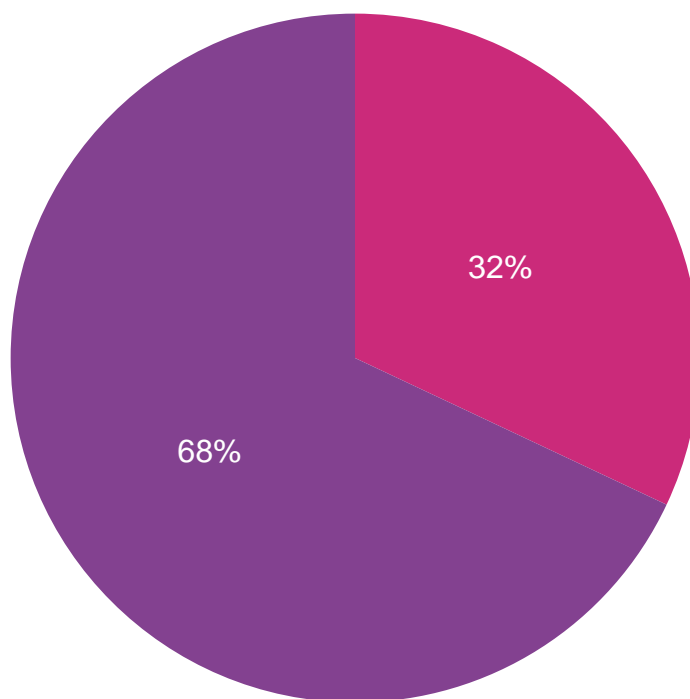| Duration of DM (Years)	No. of people
<5	16
>5	34

Fig. 1. Distribution of number of subjects with the duration of Diabetes Mellitus (DM)

Out of 50 people, 34 people have longer duration of the disease (>5years), 16 people have the disease for a shorter duration (<5 years).

Table 2. Distribution of number of subjects with the severity of Diabetes Mellitus (DM) assessed by HbA1c levels

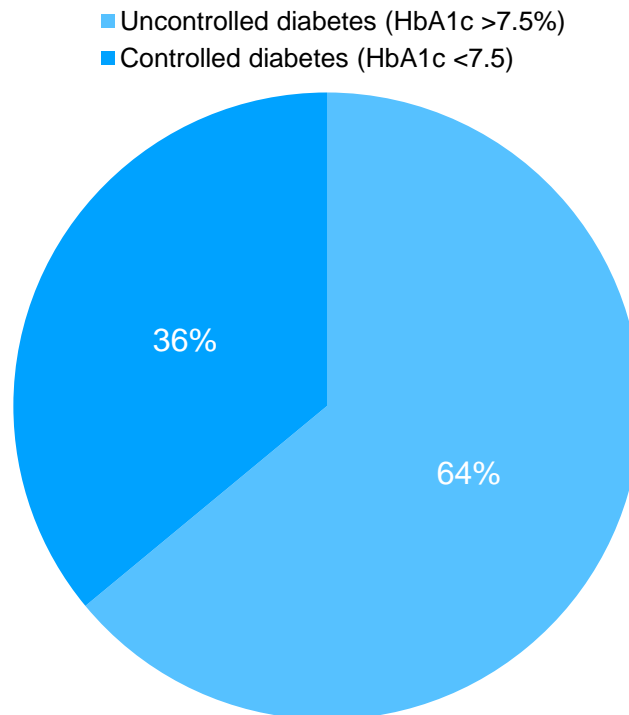| HbA1c (%)	No of people
<7.5	18
>7.5	32

Fig. 2. Distribution of number of subjects with the severity of Diabetes Mellitus (DM) assessed by HbA1c levels

Out of 50 people, 32 had uncontrolled diabetes (HbA1c >7.5%), 18 had controlled diabetes (HbA1c <7.5%).

Table 3. Tabulation of the various parameters used in assessing the risk of development of cardiac and renal complications in type 2 Diabetes Mellitus (DM) patients

Factor	No of people
1) Ejection Fraction (EF) (%)	
<50	18
>50	32
2) Regional Wall Motion Abnormality (RWMA)	
Present	18
Absent	32
3) Urea (mg/dl)	
<40	21
>40	29
4) Creatinine (mg/dl)	
<1	24
>1	26
5) Urine Protein	
Nil	23
+/++/+++	27

Table 4. Distribution of urine protein values among the subjects

Urine protein	No of people
Nil	23
+	12
++	9
+++	6

Table 5. Correlation between duration of type 2 Diabetes Mellitus with the development of cardiac, renal complications

Factor	Duration of DM < 5 years (16 subjects)	Duration of DM > 5 years (34 subjects)	Total (50 subjects)	P value (<0.05 = significant)	Significance
1. Ejection fraction (%)					
<50%	2	16	18	0.017557	Significant
>50%	14	18	32		
2. RWMA					
Present	2	16	18	0.017557	Significant
Absent	14	18	32		
3. Urea (mg/dl)					
<40 mg/dl	10	11	21	0.043931	Significant
>40 mg/dl	6	23	29		
4. Creatinine (mg/dl)					
<1 mg/dl	6	18	24	0.307982	Not Significant
>1 mg/dl	10	16	26		
5. Urine Protein					
Nil	5	18	23	0.151127	Not Significant
+/++/+++	11	16	27		

Table 6. Correlation between control of hyperglycaemia in type 2 Diabetes Mellitus with the development of cardiac, renal complications

Factor	HbA1c < 7.5 (Good control) (18 subjects)	HbA1c > 7.5 (Poor control) (32 subjects)	Total (50 subjects)	P value (<0.05 = significant)	significance
1. Ejection fraction (%)					
<50%	5	13	18	0.363648	Not Significant
>50%	13	19	32		
2. RWMA					
Present	5	13	18	0.363648	Not Significant
Absent	13	19	32		
3. UREA (mg/dl)					
<40 mg/dl	11	10	21	0.040025	Significant
>40 mg/dl	7	22	29		
4. Creatinine (mg/dl)					
<1 mg/dl	12	12	24	0.047537	Significant
>1 mg/dl	6	20	26		
5. Urine Protein					
Nil	12	11	23	0.027872	Significant
+/++/+++	6	21	27		

Out of the 50 patients who were selected for the study having type 2 Diabetes Mellitus, people with uncontrolled diabetes (HbA1c >7.5%) were more prone in developing renal and cardiac complications which were assessed by urea, creatinine, urine protein levels and ejection fraction (EF %) values.

The significant cut off values to cause complications were taken as for urea (>40mg/dl), creatinine (>1mg/dl), urine protein (+/++/+++), EF value(>50%) and the presence/absence of regional wall motion abnormality (RWMA) was noted.

It was also observed that longer age duration of the disease, (>5years) more was the risk to develop cardiac complications than disease of shorter duration.

4. DISCUSSION

The incidence of DM is increasing worldwide and rapidly assuming epidemic proportions [3].

There is a close link between duration of the disease with the poor control of hyperglycaemia with development of cardiac and renal complications. In our study we have correlated duration of DM and severity of control of DM with various parameters like Ejection Fraction (EF) value, presence/absence of Regional Wall Motion Abnormalities (RWMA), Urea, Creatinine and Urine protein [9,10].

In our study, we have studied the correlation of the above mentioned with the help of a Chi-Square test, taking p<0.05 as significance.

In a sample size of 50 taken in our study, the number of males were 29 and females were 21.

There was no relation between sex and the blood sugar levels. Similar observations were made by a study conducted by Shrestha et al. [4].

From Table 4, it has been observed that higher the protein in the urine, more is the HbA1c value which suggests that uncontrolled hyperglycaemia contributes to progressively decreasing renal functions.

From Table 5, it is evident that more longer the duration of DM, more is the chance to develop cardiac complications (assessed by EF value, presence/absence of RWMA). Longer the duration of disease, more severe was the value of urea, suggesting that the patients were prone to develop renal complications.

From the echocardiography which is used to assess the cardiac status of the patients, regional wall abnormalities were observed in our study. This was similar to the observations made by Virendra C Patil et al. [5].

Creatinine and urine protein values fluctuated with the duration of the disease and did not prove any significance with the duration of the disease.

Hence longer the duration of type 2 diabetes mellitus, greater was its significance on various parameters like EF value, presence/absence of RWMA and urea.

From Table 6, which compares the severity of the disease (assessed by the poor/good control of HbA1c) with the mentioned parameters, it was observed that more poor the control of the disease, more was the risk to develop renal complications characterised by the values of urea, creatinine and urine protein. This particular finding is similar to that study conducted by SA Bamanikar et al. [6] in which they observed that poorly controlled blood sugar levels causes a rise in urea levels which later on would increase the chances of developing renal complications like diabetic nephropathy.

In the study which was conducted by SA Bamanikar et al, duration and severity of DM had strongly correalted with the urea levels but not creatinine levels. This was not similar to our study where both urea and creatinine were affected with the poor control of the disease [11-13].

In a study which was conducted by Anjaneyulu et al. [7] had observed that increase in urea and creatinine in diabetic rats had indicated progressive damage to the kidneys.

In our study we have taken into parameters like serum urea, creatinine and urine proteins to study the risks of developing renal complications, which is similar to the study conducted by Alder Al et al. [8]. It was observed that serum levels of urea, creatinine can be used as a helpful prognostic marker of renal function and damage in diabetic patients.

Estimation of Renal Function Test are simple, economic and sensitive which can be considered as the adjuvant in management and the long duration of the disease [14,15].

5. CONCLUSION

Diabetes mellitus is fast gaining the status of a potential epidemic in India with more than 62 million individuals currently diagnosed with the disease [16].

The economic burden associated with DM is substantial in terms of direct costs of medical care and also indirect costs of lesser productivity affecting the quality of life tied to the disease [17].

A close link has been observed between DM and cardiovascular disease (CVD). CVD is one of the prevalent cause of mortality and morbidity in diabetic populations [18].

Diabetic nephropathy is the kidney disease that occurs as a result of diabetes. Nephropathy is

the leading cause of chronic renal failure worldwide [19].

It has been suggested that patients with common risk factors including longer duration of the disease, poor metabolic control are more prone to develop diabetic complications [20].

From our study, it is being observed that longer the duration of the disease with uncontrolled hyperglycaemia has a significant impact of the cardiac and renal functions.

It was also observed that inspite of longer duration of the disease, stricter control of the disease reduces the risk of renal and cardiac complications.

Hence with stricter control the incidence of risk factors are reduced and with increased duration with regular follow up and periodic checkup we can predict and prevent further incidence of morbidity and mortality.

6. LIMITATION

In our study, we have limited our study to 50 subjects. With more study group, it can help us to extend the scope of the study and help us validate the need for investigation and prevention of morbidity in the long run. The scope of study can also be extended with larger subject group with racial, geographical differences studied at a longer period of time which can arrive at more specific results.

CONSENT

As per international standard or university standard, patients' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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