# Original Research

## Prevalence of nephropathy and its parameters in patients with diabetes mellitus- A prospective study in a Central Indian Population

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**ABSTRACT:**
**Background**: Hyperglycemia is an important risk factor for the development of diabetic nephropathy. In the initial stages ie micro albuminuria the DKD is clinically detectable and can even be reversed. Hence early screening of diabetic patients is important. Hence the aim of this study was to evaluate the prevalence of nephropathy in a cross section of diabetic patients. **Objectives**: The Aim of our study was to evaluate the prevalence of nephropathy in recently detected diabetic patients by evaluating microalbuminuria, serum creatinine and creatinine clearance. **Methods**: A total of 120 patients above 18 years were included in the study and were divided into three groups according to age and were further divided into three groups as per the duration of diseases Patients were again divided into two groups according to the gender. The GFR was calculated as per the MDRD formula and the patients were divided further as per the stage of CKD. Serum Creatinine levels were calculated and the variables associated with CKD were adjusted by Logistic Regression. **Results**: Our results suggests that 41.25% of subjects were in mild to severe nephropathy out of which 16.25 % were within the three years of diagnosis, thus suggesting the role of early and routine investigation in diabetic patients. **Conclusion:** Hence the role of life style is clearly emphasized by our results. Although when the variables were adjusted with the logistic regression the occupation was not that significant.
**Keywords**: Albuminuria, Diabetes mellitus (DM), Diabetic Kidney Disease (DKD), Diabetic nephropathy (DN), Serum Creatinine.

## INTRODUCTION

Diabetes mellitus (DM), commonly known as diabetes, is a group of metabolic disorders characterized by a high blood sugar level over a prolonged period of time. Type 2 DM is the most common form of diabetes. The maximum increase in number of Diabetic patients is observed in India during the last few years. Due to this high prevalence and rapidly increasing number of patients of diabetes in India; it has become the world's diabetic capital.[1]

Consistently high blood glucose levels can lead to serious diseases affecting the heart and blood vessels, eyes, kidneys, nerves and teeth. In addition, people with diabetes also have a higher risk of developing infections.

Diabetic nephropathy (DN) is also known as Diabetic Kidney Disease (DKD). It is the chronic loss of kidney function occurring in the patients suffering from DM. DN is the chief cause of kidney diseases in the patients needing Renal replacement therapy, out of which around 40% of the patients suffer from DM suggesting that the DM is a one of the commonest cause of Nephropathy. DN leads to increase risk of loss of life. The DN can be divided in to two stages micro

albuminuria (UAE 20>g/min and ≤199 μg/min) and macro albuminuria (UAE ≥200 μg/min).[2] Reactive Oxygen species produced in the diabetic patient damages the glomeruli of kidney leading to albuminuria. Diabetic nephropathy has been characteristically defined by the presence of proteinuria >0.5 g/24 h. As diabetic nephropathy progresses, a structure in the glomeruli known as the glomerular filtration barrier (GFB) is increasingly damaged. Urinary albumin excretion in the diabetic patient marks the onset of DKD. From normal albuminuria to micro and macro albuminuria the DKD progress. In the initial stages ie micro albuminuria the DKD is clinically detectable and can even be reversed. Hence the importance of screening of diabetic patients comes in to light. It has been observed that out of the type II patient diagnosed about 7% are already in the micro albuminuria stage at the time of diagnosis.[3] Evidence suggests that the risk for developing DKD[4-6] and cardiovascular disease[7,8] starts when values of UAE are still within the normal albuminuria range. It has also been observed that progression of micro albuminuria or macro albuminuria is more common in the patients of type II Diabetes. Hence the first screening of diabetic patients is recommended after 5 yrs of diagnosis of the disease.[2] Hence we conducted this study to evaluate the prevalence of nephropathy in recently detected diabetic patients.

**MATERIAL AND METHODS**

The Aim of our study was to evaluate the prevalence of nephropathy in diabetic patients. This study was conducted in Department of General Medicine, Shri Shankaracharya Medical College, Bhilai, Chhattisgarh from September 2019 to May 2020.

Patients attending the Nephrology clinic and were newly diagnosed as diabetic were recruited in the study after written informed consent taken from them.

Patients with age more than 18 years were included in the study. Exclusion criteria of the study included Patients having type 1 diabetes, Known case of diabetes diagnosed by ADA criteria for less than a year, Patients having other systemic disorders like hypertension, thyroid disease etc.

- A complete history, clinical examination and investigative profile will be carried out in each patient for nephropathy.
- A 24-h urine collection,
  - To measure serum creatinine by Jaffe's method by Merilyzer Autoquant 400 fully auto-analyzer.
  - Microalbumin Pyrogallol Red method (between 30-299 mg/24 hours) in Microlab 300 semi- auto-analyzer.
  - Creatinine clearance measured by e-GFR using MDRD formula as follows-

$$\text{e-GFR}=186 \times (\text{creatinine}/88.4)^{-1.154} \times (\text{age})^{-0.203} \times 0.742 \text{ -(if female)}$$
$$\text{e-GFR}=186 \times (\text{creatinine}/88.4)^{-1.154} \times (\text{age})^{-0.203} \times 1.210 \text{ -(if male)}$$

**RESULTS:**

Table 1: Demographic variables

| Characteristics | Group | Number | Percentage (%) |
|---|---|---|---|
| **Age group (years)** | 18-30 | 18 | 22.5 |
| | 31-50 | 24 | 30 |
| | 51< | 38 | 47.5 |
| **Duration (years) of Diabetes Mellitus** | A= upto 1 | 26 | 32.5 |
| | B= 1-3 | 22 | 27.5 |
| | C= < 3 | 32 | 40 |
| **Gender** | Male | 46 | 57.5 |
| | Female | 34 | 42.5 |
| **Occupation** | Labour | 20 | 25 |
| | Professional | 36 | 45 |
| | Nonworking | 24 | 30 |

Table 1 describes the demographic variables of the groups. The participats were first divided in to groups according to the age. The total participants in age group 18-30 years were 18 which were 22.5% of total recruits. In the age group 31-50 the number of participants was 24 and these were 30% of the total recruits. In the age group of 51 and above the number of recruits were 38 which form the res 47.5% of the recruits.

The participants were then divided again according to the duration of the DM. Group A included patients who were diagnosed with DM in last 1 year. There were 22 recruits in this group forming 32.5 % of the total. In group B the patients who were diagnosed with DM within 1-3 years and the total N in this group was 22 making 27.5%. In Group C those patients were kept who have been diagnosed with DM with more than 3 years and these were total 32 forming 40% of the total recruits.
The participants were then again divided as per the gender. There were 46 males making 57.5% of the recruits and Females 34 which were remaining 42.5% of recruits.
The participants were further divided as per their occupation which included laborers total 20 forming 25% of the recruits, Professionals which were 45% and Nonworking were 24 forming 30% of the recruits.

Table 2: associated abnormal conditions

| Conditions | Age group | | | Duration of DM | | | Total (%) |
|---|---|---|---|---|---|---|---|
| | 18-30 | 31-50 | 51< | A | B | C | |
| **Hypertension** | 1 | 6 | 12 | 3 | 7 | 9 | 23.75 |
| **Obesity** | 2 | 8 | 10 | 1 | 8 | 11 | 25 |
| **Smoking** | 4 | 7 | 5 | 2 | 6 | 8 | 20 |

Table 2 shows that out of 80 selected subjects 23.75% were having hypertension, 25% were obese and 20% were smokers.

Table 3: Stratification of the population according to the GFR (n=120)

| GFR categories (ml/min/1.73 m$^2$) | MDRD no. (%) |
|---|---|
| >90 Stage I | 47(58.75) |
| 60-89 Stage II | 15(18.75) |
| 30-59 Stage III | 11(13.75) |
| 15-29 Stage IV | 6(7.5) |
| <15 Stage V | 1(1.25) |

GFR – Glomerular Filtration Rate, MDRD- Modification of Diet in Renal Disease

GFR was calculated by MDRD formula. Patients having GFR More than 90ml/min/1.73 m$^2$ were 58.75%, those having GFR between 60-89 ml/min/1.73 m$^2$ were 18.75%, 13.75 % of participants were having GFR in the range of 30-59ml/min/1.73 m$^2$, the percentage of subjects having GFR 15-29ml/min/1.73 m$^2$ was 7.5 and only 1.25 % were found to have GFR less than 15ml/min/1.73 m.$^2$
It was observed that 41.25% of the subjects were in the range of mild to severe nephropathy.
With 1.25% falling under the most severe range.

Table 4: serum creatinine levels

| Characteristics | Group | Serum creatinine | |
|---|---|---|---|
| | | Normal | Abnormal |
| **Age group (years)** | 18-30(n=18) | 15 | 3(16.66%) |
| | 31-50 (n-24) | 17 | 7(29.16%) |
| | 51< (n=38) | 15 | 23(60.5) |
| **Duration (years) of Diabetes Mellitus** | A= upto 1(n=26 | 25 | 1(3.84%) |
| | B= 1-3(n=22) | 10 | 12 ((54.54) |
| | C= more than 3 (n=32) | 12 | 20 (62.5%) |
| **Gender** | Male (n=46) | 27 | 19(41.03%) |
| | Female (n=34) | 20 | 14((41.17%) |

Table 4 shows the number of subjects having normal and abnormal values of creatinine with in each group. It was observed that as the age increases the value of creatinine shifts more towards abnormality, suggesting that the age is directly proportional to the decreasing kidney function.in the age group 18-30 16.66 % of the subjects show deranged creatinine values. In the group with age between 31-50 29.16 % had higher than normal creatinine values and in the age group above 51 the abnormal values were highest with 60.5 % of the subjects.

When the groups were arranged as per the duration of the disease we found that in the group A only 3.84% had abnormal creatinine values, in group B the percentage increases to 54.54% and in Group C it further increased to 62.5%. When the gender was compared no significant difference was found.

Table 5: serum creatinine level in DN and NDN

| Characteristics | Group | Serum creatinine (Mean ± SD) (mg/dl) | |
| --- | --- | --- | --- |
| | | Normal | Abnormal |
| **Age group (years)** | 18-30 | 1.05 ± 0.17 | 1.50 ± 0.11 |
| | 31-50 | 0.97 ± 0.17 | 1.10 ± 0.21 |
| | 51< | 0.97 ± 0.17 | 1.10 ± 0.21 |
| **Duration (years) of Diabetes Mellitus** | A= upto 1 | 0.97 ± 0.17 | 1.10 ± 0.21 |
| | B= 1-3 | 0.97 ± 0.17 | 1.10 ± 0.21 |
| | C= more than 3 | 0.97 ± 0.17 | 1.10 ± 0.21 |
| **Gender** | Male | 0.97 ± 0.17 | 1.10 ± 0.21 |
| | Female | 0.97 ± 0.17 | 1.10 ± 0.21 |

Table 5 describes the Serum creatinine levels in DN and NDN. In the age group 18-30 yrs the mean of abnormal values was 1.5±0.11, in 31-50 yrs it was 1.1±0.21, in the group 51 yrs and above it was 1.1±0.21. In Groups A,B anc C the value was 1.1±0.21 and there was no difference in the values of males and females group as well.

Table 6: variables associated with CKD by logistic regression.

| Variable | Logistic regression | | | |
| --- | --- | --- | --- | --- |
| | p- value | OR | 95% for CI for OR | |
| | | | Upper | Lower |
| **Age group (yr)** | 0.001 | 1.042 | 1.026 | 1.049 |
| **Gender** | 0.386 | 0.821 | 0.568 | 1.251 |
| **Occupation** | 0.879 | 0.885 | 0.536 | 1.748 |

The logistic regression analysis shows that only age shows significance and gender and occupation have no significance for the CKD.

## DISCUSSION

Diabetic nephropathy (DN) is the chronic loss of kidney function occurring in the patients suffering from DM. Diabetes is a disease which is now seen more like an epidemic, no country, age group or sex is spared from this disease. India is currently considered a Diabetic capital of the world. With such large number of diabetic patients in India it is posing a great health and economical challenge.

Prolonged uncontrolled diabetes comes with a set of complications. The complications of diabetes are widely classified as Microvascular and Macrovascular complications. Macrovascular complications of diabetes include coronary artery disease, peripheral arterial disease, and stroke and Microvascular complications of diabetes include long-term complications that affect small blood vessels. Retinopathy, neuropathy, and nephropathy fall under this category. It is observed that diabetic nephropathy is one of the main causes of renal transplant. It is the one which increases the risk of Death in Diabetic patients. The cost of regular dialysis is also posing the economic burden on the society. Regular follow up, periodic investigation for achieving

the best metabolic control, treating hypertension if present and using drugs with blockade effect on the renin angiotensin-aldosterone system, along with treating dyslipidemia were the effective strategies for preventing and delaying with microvascular complications of diabetes.

The screening for nephropathy should begin from the time of diagnosis of diabetes as it is observed that about 7 % of the patients diagnosed with diabetes already have microalbuminuria.

Albumin concentration in urine, serum creatinine and creatinine clearance are good indicators of kidney health hence in our study we followed the standard protocol to measure these three for analyzing the kidney function. Out of all the recruited patients the maximum patients we found were more than 51 years of age, closely followed by the 30-50 yrs age group, but the rise of diabetes in lower age group ie 18-29 is alarming. While comparing the gender no significant difference was observed suggesting that both male and females are equally susceptible to the diseases. Although the occupation showed some relevance where nonworking group was more affected and least affected group was

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that of labourers suggesting that group involved in high physical work is less susceptible to the disease as compared to the one with sedentary life style. Hence the role of life style is clearly emphasized by our results. Although when the variables were adjusted with the logistic regression the occupation was not that significant.

Creatinine clearance was measured by e-GFR using MDRD formula. Our results suggest that 41.25% of subjects were in mild to severe nephropathy, thus suggesting the role of early and routine investigation in diabetic patients. Our results were in consistence with the study conducted by patel V.[10]

The percentage of newly diagnosed patients ie within 1 year with nephropathy in our study was 3.84%. In the study conducted by Alder et al[3] the percentage of nephropathy in newly diagnosed diabetes patients was 7.3%. The percentage of patients with nephropathy increased to 16.25 % when all the patients within 3 years of diagnosis were considered. Our results were found to be consist with Agarwal N et al[11] in their study the percentage was 17.34%which in in close association with our results.

When we compared the serum creatinine levels among the groups we found that age was an important factor. Maximum abnormal values were reported from the age group of 51 and above years and least from 18-30 years age group, suggesting that age plays an important role when kidney function disorder due to diabetes is considered. These results were in unison with the study conducted by Russo GT.[12]

When the duration of diseases was considered it was found that more the duration more the percentage of subjects with abnormal creatinine values. our study verify the results of study conducted by Inassi J et al[13]

The gender does not seem to affect the progression of CKD. This was confirmed by logistic regression as well.

When the variables were adjusted with logistic regression it was observed that age played a significant role in developing diabetic nephropathy.

## CONCLUSION

It is observed that diabetic nephropathy is one of the main causes of renal transplant. The screening for nephropathy should begin from the time of diagnosis of diabetes as it is observed that about 7 % of the patients diagnosed with diabetes already have microalbuminuria. Our results suggests that 41.25% of subjects were in mild to severe nephropathy out of which 16.25 % were within the three years of diagnosis, thus suggesting the role of early and routine investigation in diabetic patients. Hence the role of life style is clearly emphasized by our results. Although

when the variables were adjusted with the logistic regression the occupation was not that significant.

## REFRENCES

1. Ramachandran A. Epidemiology of type 2 diabetes in Indians. J Indian Med Assoc. 2002 Jul;100(7):425-7
2. American Diabetes Association: Nephropathy in diabetes (Position Statement). Diabetes Care 27 (Suppl.1):S79– S83, 2004
3. Adler AI, Stevens RJ, Manley SE, Bilous RW,CullCA,HolmanRR:Development and progression of nephropathy in type 2 diabetes: the United Kingdom Prospective Diabetes Study (UKPDS 64). Kidney Int 63:225–232, 2003
4. Forsblom CM, Groop PH, Ekstrand A, Totterman KJ, Sane T, Saloranta C, Groop L: Predictors of progression from normoalbuminuria to microalbuminuria in NIDDM. Diabetes Care 21:1932– 1938, 1998 16.
5. GallMA,HougaardP,Borch-JohnsenK, Parving HH: Risk factors for development of incipient and overt diabetic nephropathy in patients with non-insulin dependent diabetes mellitus: prospective, observational study. BMJ 314:783– 788, 1997
6. Murussi M, Baglio P, Gross JL, Silveiro SP: Risk factors for microalbuminuria andmacroalbuminuriaintype2diabetic patients: a 9-year follow-up study. Diabetes Care 25:1101– 1103, 2002 17. The Microalbuminuria Collaborative Study Group: Predictors of the development of microalbuminuria in patients with type 1 diabetes mellitus: a sevenyear prospective study. Diabet Med 16: 918–925, 1999 18.
7. Gerstein H, Mann J, Yi Q, Zinman B, DinneenS,HoogwerfB,HalleJ,YoungJ, Rashkow A, Joyce C, Nawaz S, Yusuf S: Albuminuria and risk of cardiovascular events, death, and heart failure in diabeticandnondiabeticindividuals.JAMA 286:421–426, 2001
8. Yusuf S, Sleight P, Pogue J, Bosch J, Davies R, Dagenais G: Effects of an angiotensin-converting-enzyme inhibitor, ramipril, on cardiovascular events in high-risk patients: the Heart Outcomes Prevention Evaluation Study Investigators. N Engl J Med 342:145–153, 2000 20.
9. Stephenson JM, Fuller JH: Microalbuminuria is not rare before 5 years of IDDM: EURODIAB IDDM Complications Study Group and the WHO Multinational Study of Vascular Disease in Diabetes Study Group. J Diabetes Complications 8:166–173, 1994
10. Patel V et al. A study in prevalence of diabetic nephropathy in recently detected cases of type 2 diabetes mellitus as evidenced by altered creatinine clearance, urinary albumin and serum creatinine, with special emphasis on hypertension, hypercholesterolemia and obesity Int J Adv Med. 2018 Apr;5(2):351-355
11. Agarwal N, CA, Holman RR: Development and progression of nephropathy in type 2 diabetes: the United Kingdom Prospective Diabetes Study (UKPDS 64). Kidney Int 63:225–232, 2003
12. Russo GT, De Cosmo S, Viazzi F, et al. Diabetic kidney disease in the elderly: prevalence and clinical correlates. BMC Geriatr. 2018;18(1):38. Published 2018 Feb 2. doi:10.1186/s12877-018-0732-4
13. Inassi J, Vijayalakshmy R. Role of duration of diabetes in the development of nephropathy in type 2 diabetic patients. NJMR 2013:3(1):5-8.