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Original Research Article

# Targeted and Opportunistic Screening of Type 2 Diabetes Mellitus Cases in Tertiary Care Hospital

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## Abstract

Macro-vascular and micro-vascular complications of diabetes significantly cause morbidity and mortality among diabetic subjects in India. The study was to assess the prevalence of micro vascular complications of newly diagnosed type 2 diabetic subjects and to analyze the relationship of occurrence of micro vascular complications with its risk factors in a tertiary care teaching and multi specialty hospital. The targeted and opportunistic screening analysis shows that the mean age of diabetic subjects' were 54.27±9.27 years and 72.09% of newly diagnosed cases. The overweight 37.20%, hypertension 30.23%, diabetic neuropathy 25.56%, diabetic retinopathy 11.62%, diabetic nephropathy 18.60% and in the present study, 55.81% of asymptomatic newly diagnosed type 2 Diabetes patients had at least one or more microvascular complications. Type 2 diabetes is characterized by a long asymptomatic period before it is diagnosed. In our study the results shows significant association of these risk factors in Type 2 diabetes and was treated as early as possible to decrease the progression of vascular complications.

**Keywords:** Micro vascular complications, monofilament test, retinopathy, peripheral neuropathy, targeted and opportunistic screening.



## INTRODUCTION

The global prevalence of Diabetes is estimated to increase from 4% in 1995 to 5.4 % by the year 2025 [1]. According IDF Diabetes Atlas'by International Diabetes Federation, the global prevalence of diabetes and IGT for 2010 has been estimated to be 6.6% and 7.8% respectively, for adults aged 20-79 years. The World Health Organization has predicted that the major burden of diabetes will occur in developing countries. There will be a 42% increase from 51 to 72 million in the developed countries and 170% increase from 84 to 228 million in the developing countries. The countries with the largest number of diabetic people are, and will be in the year 2025, India, China and United States [2, 3].

Epidemiological studies among migrant Asian - Indians in many countries showed higher prevalence of type 2 diabetes compared with most populations. Studies conducted in India in the last decade have highlighted that not only is the prevalence of type 2 diabetes high, but also that it is increasing rapidly in the urban population. Various organizations like.

Indian Council of Medical Research (ICMR, New Delhi) [4] , The National Urban Diabetic Survey (NUDS, 2000) [5] ,The Amrita Diabetes and Endocrine population survey (ADEPS) in Kerala [5], The Chennai Urban Rural Epidemiological Study (CURES) [6] , showed the prevalence of type2 diabetes studies showed, a rising trend in the prevalence of diabetes across different parts of India.

In India the burden of macro-vascular and micro-vascular complications of diabetes significantly cause morbidity and mortality among diabetic subjects. Various organizations like The Chennai Urban Population study (CUPS), The Chennai Urban Rural Epidemiological Study (CURES), The Chennai Urban Rural Epidemiological Study (CURES) were provided valuable data from India on vascular complications related to diabetes. And the prevalence of coronary artery disease (CAD), peripheral vascular disease (PVD), diabetic retinopathy, microalbuminuria data shows that Asians particularly, Indians have a greater predilection for cardiovascular complications and microvascular complications are less as compared to western population [5-9].

Risk factors associated with vascular complications of diabetes mellitus are the hypertension

and its associated cholesterol, triglycerides and history of coronary heart disease. All the research shows that in spite of high prevalence rates of diabetes in South India, more studies are needed from different parts of India. It is clear from above references that a large number of newly diagnosed diabetic patients suffer from some or other complication of diabetes. Most of studies have shown that the prevalence rate of complications is quite high even what the diabetic journey just begins. The objectives of the study were to assess the prevalence of micro vascular complications at the time of diagnosis in newly diagnosed asymptomatic type 2 diabetes mellitus patients and to study the relationship of occurrence of micro vascular complications with various risk factors.

## PATIENTS AND METHODS

The study was carried out at P.G. Department of Medicine, S.N. Medical College, Agra. 86 consecutive newly diagnosed diabetic subjects aged ≥20 years were selected based on fasting blood glucose ≥126 mg/dl from patients attending medicine outdoor, indoor wards in the period of January 2011 to June 2012. They presented to the hospital either with symptoms of some illness or for routine checkup and diabetes was detected for the first time and checked with *ADA 2010 Criteria for Diagnosis of diabetes guidelines.*

**Inclusion Criteria**

- All individuals' ≥20 years of age willing to participate in study who have their diabetic status unknown or not a diabetic.
- All individuals who have a high risk factor for diabetes as per ADA 2008 guidelines.

**Exclusion Criteria**

- All individuals who are known diabetic.
- All undiagnosed individuals presenting with symptoms suggestive of diabetes or its complications.
- Patients on hyperglycemic drugs eg.chronic corticosteroids, thiazides, glucagon.
- Patients with known disorders of exocrine pancreas eg neoplasia, pancreatectomy

**Study Population**

The study cases were both targeted and opportunistic screening was recruited.

**Targeted Screening**

A risk assessment questionnaire to identify high risk subjects was provided. ADA 2010 guidelines for testing diabetes in asymptomatic adults were used with the following patients who came to out at P.G. Department of Medicine, S.N. Medical College, Agra. After screening the individual was selected and subjected to 8 hours fasting plasma glucose test.

- All adults who are overweight (BMI≥25 kg/m$^2$)
- Physical inactivity, 1$^{st}$ degree relative with diabetes,
- All adults ≥ 45 years of age.

**Opportunistic Screening**

Patients attending to outdoors and inpatients with symptoms & signs of risk factors for diabetes were subjected to 8 hours fasting plasma glucose test.

Individuals with fasting plasma glucose < 100 mg/dL were considered normoglycemic. Individuals with fasting plasma glucose >100 mg/dL but <126 mg/dL were considered to have Impaired Fasting Glucose (IFG). IFG is a risk factor for future diabetes; they were motivated for a repeat test or OGTT on a different day for definitive diagnosis. Results of screening test were explained to patients so that follow up evaluation and treatment can be made available to them. All these newly diagnosed diabetic subjects were invited for extensive medical examination for the presence or absence of various micro vascular complications diagnosis. Informed consent was taken from all the subjects. All participants were evaluated according to protocol.

All participants were given a preformed questionnaire consisting of 5 parts:

**Part A:**

Socio demographic status: Including age, sex, address, socioeconomic status, physical activity.

**Part B:**

Clinical assessment: height, weight, waist circumference, BMI, blood pressure, pulse rate.

**Part C:**

Whether known diabetic, can / cannot be included, not eligible for study.

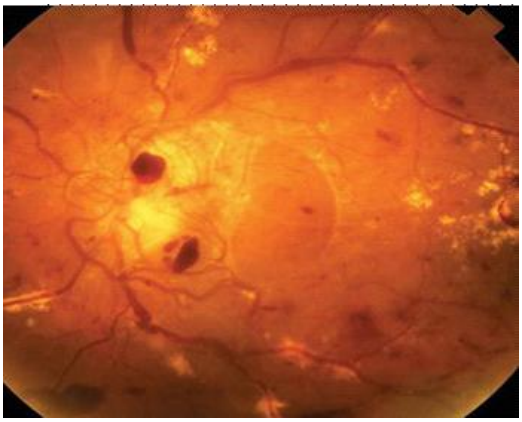
**Part D:**

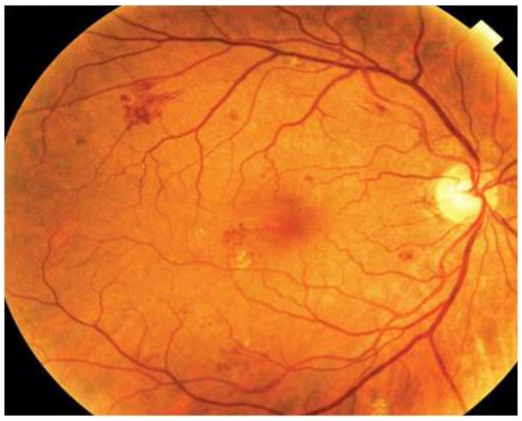
**Assessment for presence of complications:** The study groups were evaluated for presence or absence of various complications:

**A) Micro vascular complications:**

**Retinopathy**

It was assessed by dilating pupils with 1% tropicamide and assessing the fundus 15 minutes later by direct ophthalmoscopy. Results were recorded for - micro aneurysms, intra-retinal dot and blot or flame shaped hemorrhages, hard exudates venous loops, beads or reduplication, arterial sheathing, AV shunts, multiple cotton wool spots, multiple extensive hemorrhages and new vessels [10-15].





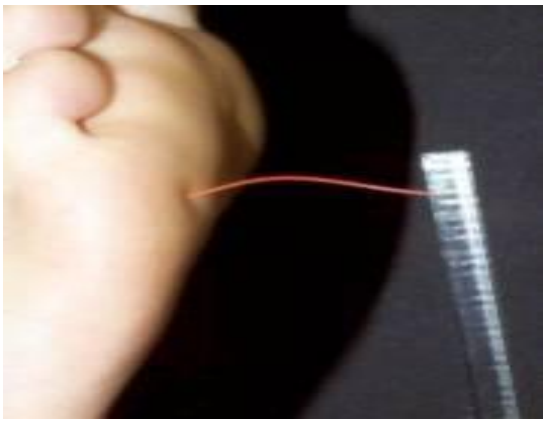
**Screening for micro vascular complications proliferative diabetic retinopathy and non proliferative diabetic retinopathy**

**Neuropathy**

The subjects were tested for peripheral neuropathy and autonomic neuropathy. If peripheral neuropathy and/or autonomic neuropathy were detected in any patient, he/she was labeled to have the complication of diabetic neuropathy.

**Part E:**
**Diabetic peripheral neuropathy measurement**

Diabetic peripheral neuropathy was measured with the criteria of insensitivity to 5.07 (10g) Semmes Weinstein monofilament, absent ankle jerk by percussion hammer, loss or diminution of vibration sense with 128 Hz tuning fork and abnormal testing for pain and temperature. The filament was placed perpendicular to the skin of feet and pressure was applied until the filament just bends. 9 plantar and 1 dorsal sites were tested in each foot. Responses were recorded in the form of yes or no. Insensitivity to 4 out of 10 sites was taken as loss of protective sensation and person was labeled as suffering from diabetic neuropathy [16].



**Monofilament test (Semmes Weinstein)**

**Diabetic autonomic neuropathy measurement**
**(a) Tests for Parasympathetic function:**
**Heart rate response to valsalva**

The patients were asked to forcefully exhale into the rubber tubing of sphygmomanometer to raise the pressure to 40 mmHg for 15 seconds. Simultaneous ECG was recorded. The ratio of longest RR interval and shortest RR interval was measured. If ≤1.2, it was considered abnormal response.

**Heart rate response to deep breathing**

Subject was asked to lie quietly and takes deep breaths at a rate of 6/minutes and ECG was recorded. Difference between maximum and minimum heart rate was calculated. A difference in HR of < 10 beats per minute was considered abnormal response.

**(b) Tests for sympathetic function:**
**Blood Pressure (BP) response to standing**

BP was measured in lying down position and again 2 minutes after standing. Systolic BP fall of ≥ 20 mmHg or diastolic BP fall of ≥10 mmHg was taken as abnormal response.

**Blood Pressure (BP) response to sustained hand grip**

Subject was asked to maintain hand grip at 30% of maximum voluntary contraction for 5 minutes. BP was measured every minute in contra lateral arm. The difference in diastolic BP just before release of hand grip and that after starting was measured. A diastolic BP rise of <16 mmHg was considered abnormal. If any of above tests were abnormal, patient was labeled as having the complication of diabetic autonomic neuropathy.

**Nephropathy**

**Micro-albuminuria**

The urinary albumin to creatinine ratio (ACR) in 1st morning urine sample was calculated to determine the presence of micro-albuminuria. Urinary albumin and creatinine were measured using the Cobas Integra System (Roche Diagnostics). Urinary albumin was measured by immuno-turbidimetric method. Urinary creatinine was measured by the kinetic Jaffe reaction. Normal albumin to creatinine ratio (ACR) is <30 µg/mg. Subjects were classified as having micro-albuminuria if they had ACR value between 30-299 µg/mg [17].

**Macro-albuminuria**

Presence of overt proteinuria on urine examination by dipstick or a value of ACR of ≥ 300µg/mg was considered as macro-albuminuria. Confounding factors like exercise within 24 hours, infection, fever, CHF were excluded. If micro-albuminuria or macro-albuminuria was detected the patient was labeled as having the complication of diabetic nephropathy.

## RESULTS AND DISCUSSION

The study was conducted on newly diagnosed type 2 diabetes patients selected from Medicine outdoor, indoor wards of S.N. Medical College, Agra in the period of January 2011 to June 2012. A total of 86 consecutive newly diagnosed type 2 diabetes patients were included in study out of which 50 were male and 36 were female. A thorough history, physical examination and relevant investigations were carried out to find out various microvascular and macrovascular complications present in them at the time of diagnosis of diabetes. The results were analyzed statistically.

**Table-1: Results of distribution of study population according to age and sex**

**Distribution of study population according to age and sex (N=86)**

| Age (years) | Male | Female | Total |
|---|---|---|---|
| 20-29 | - | - | - |
| 30-39 | 4 | - | 4 |
| 40-49 | 12 | 8 | 20 |
| 50-59 | 24 | 18 | 42 |
| 60-69 | 8 | 6 | 14 |
| 70-79 | 2 | 4 | 6 |
| 80-89 | - | - | - |
| TOTAL No- (%) | 50 (58.13%) | 36 (41.86%) | 86 (100%) |

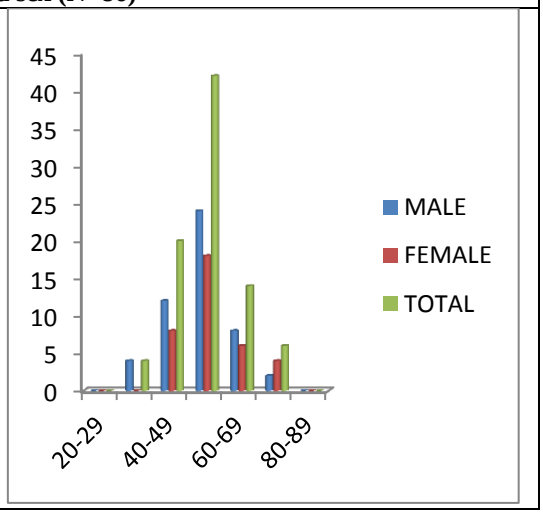



**Table-2: Results of distribution of study population according to their basal metabolic index (BMI)**

**Distribution of study population according to their basal metabolic index (BMI)**

| BMI (kg/m$^2$) | Male | Female | Total (no) | Total (%) |
|---|---|---|---|---|
| Underweight (<18.5) | - | 2 | 2 | 2.32 |
| Normal (18.5-24.9) | 14 | 10 | 24 | 27.90 |
| Overweight (25-29.9) | 20 | 12 | 32 | 37.20 |
| Obese (≥30) | 16 | 12 | 28 | 32.55 |
| Total | 50 | 36 | 86 | 100 |

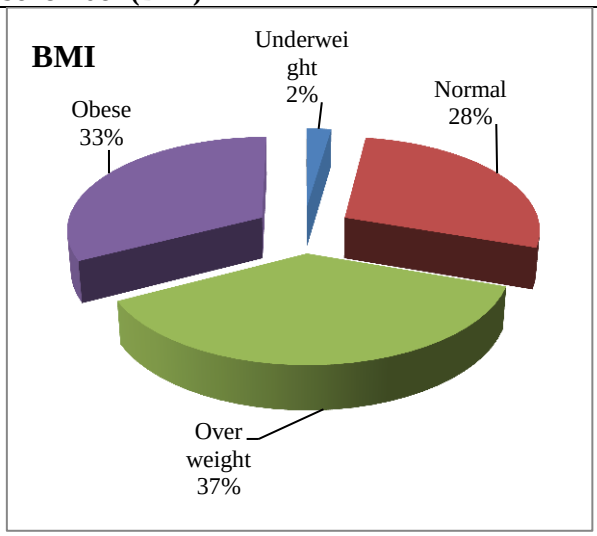


**Table-3: Results of prevalence of hypertension in newly diagnosed asymptomatic diabetic patients**

**Prevalence of hypertension in newly diagnosed asymptomatic diabetic patients (n-86)**

| Hypertension | No of cases | Prevalence (%) |
|---|---|---|
| Stage 1 (140-159/90-99) | 18 | 20.93% |
| Stage 2 (≥160/100) | 8 | 9.30% |
| Overall | 26 | 30.23% |

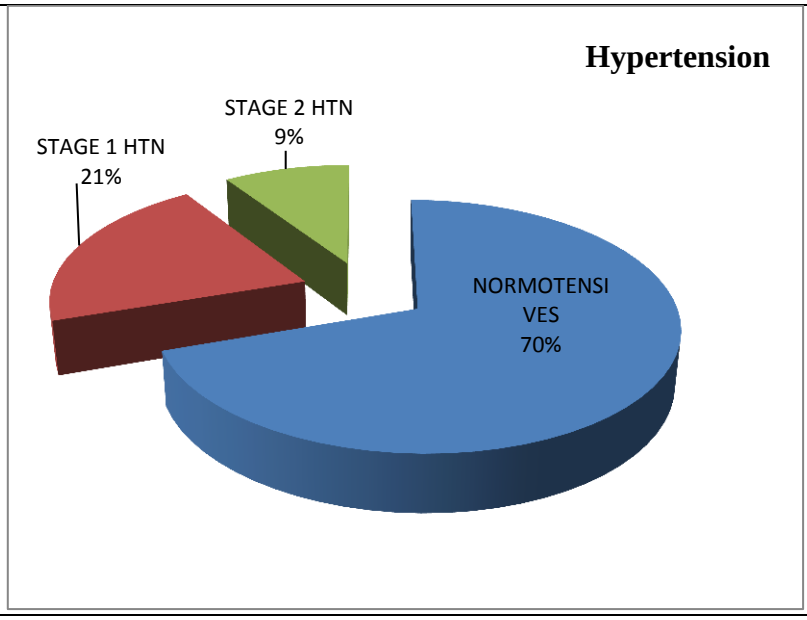



**Table-4: Results of prevalence of neuropathy in newly diagnosed asymptomatic and diabetic patients**

**Prevalence of neuropathy in newly diagnosed asymptomatic and diabetic patients**

| **Neuropathy** | **No cases** | **Prevalence %** |
|---|---|---|
| Peripheral neuropathy | | |
| Only symptoms | - | - |
| Only signs | 20 | 23.25% |
| Both symptoms and signs | - | - |
| Overall | 20 | 23.25% |
| Autonomic neuropathy | 2 | 2.32% |
| Diabetic neuropathy (overall) | 22 | 25.58% |

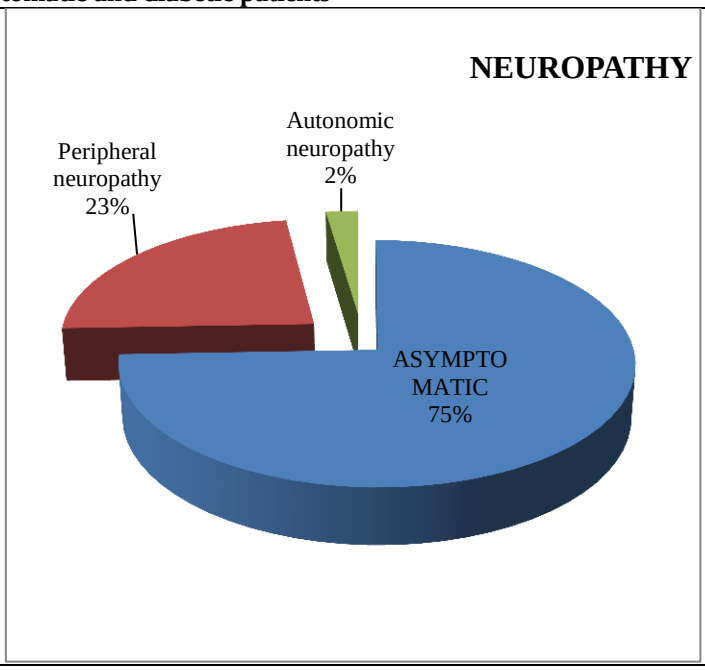



**Table-5: Results of prevalence of retinopathy in newly diagnosed asymptomatic diabetic patients**

| **Prevalence of retinopathy in newly diagnosed asymptomatic diabetic patients** | | |
|---|---|---|
| Retinopathy | No | Prevalence |
| Non proliferative diabetic retinopathy | 10 | 11.62% |
| Proliferative diabetic retinopathy | - | - |
| Total diabetic retinopathy | 10 | 11.62% |

**Table-6: Results of prevalence of nephropathy in newly diagnosed asymptomatic diabetic patients**

| Prevalence of nephropathy in newly diagnosed asymptomatic diabetic patients | | |
|---|---|---|
| Nephropathy | No | Prevalence |
| Micro-albuminuria | 12 | 13.95% |
| Macro-albuminuria | 4 | 4.65% |
| Total diabetic nephropathy | 16 | 18.60% |

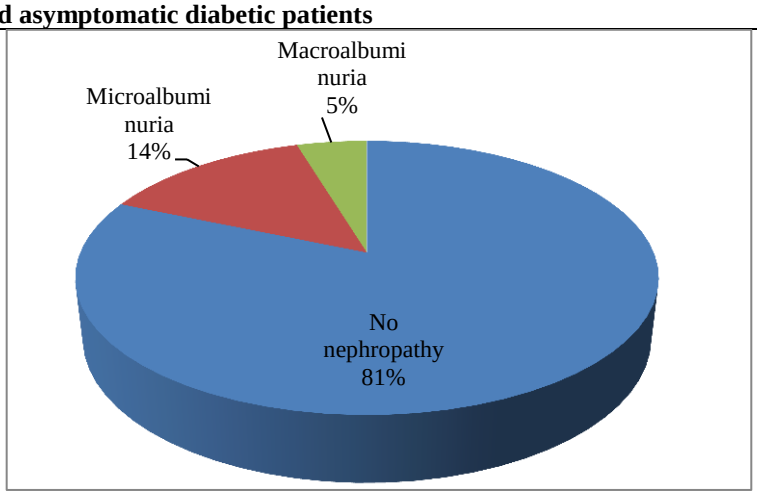



**Table-7: Results of smoking as a risk factor**

| Smoking | Study group | Control group | Total | P value |
|---|---|---|---|---|
| Present | 25 | 5 | 30 | 0.01 |
| Absent | 31 | 25 | 56 | |
| Total | 56 | 30 | 86 | |

**Table-8: Results of alcoholism as a risk factor**

| Alcoholism | Study group | Control group | Total | P VALUE |
|---|---|---|---|---|
| Present | 10 | 6 | 16 | 0.780 |
| Absent | 46 | 24 | 70 | |
| Total | 56 | 30 | 86 | |

## DISCUSSION

Diabetes mellitus is a chronic metabolic disorder and has a high prevalence in India. Hyperglycemia associated with diabetes leads to a number of microvascular and macrovascular complications, which are a significant cause of morbidity and mortality among diabetic subjects. The risk of chronic complications increases as a function of duration of hyperglycemia. They usually become manifest in second decade of hyperglycemia. Type2 diabetes is characterized by a long asymptomatic period of hyperglycemia and many individuals with type 2 diabetes have complications even at the time of diagnosis.

This study was undertaken to find out the prevalence of various Microvascular and Macrovascular complications at the time of diagnosis of type2 diabetes and their relation with various risk factors in a representative population of North India. In present study, a total of 86 consecutive newly diagnosed type 2 diabetes patients were selected from Medicine OPD, wards from Jan 2011 to Jun 2012.

Table-1 data shows that out of 86 asymptomatic newly diagnosed diabetes patients, 50 (58.13%) were male and 36 (41.86%) were female. Mean age of asymptomatic group was 54.27±9.27 years. Out of 86 subjects, 50 were male and 36 were female. Thus the proportion of male and female cases was 58.13% and 41.86% respectively. Male: female ratio in the current study was 1.38:1 the results were similar as in previous study done by Ramchandran *et al.*, [18]. In the age distribution study, mean age of study population was 54.27 ± 9.27 years and the cases were divided into 7 classes (20-29, 30-39, 40-49, 50-59, 60-69, 70-79 and 80-89 years) based on age. In 20-29 years group, there was no patient. 23.25% patients were in 40-49 years age group and 48.83% patients were in 50-59 years age group. Hence 72.08% of total newly diagnosed diabetic patients were in age group 40-59 years. Notably, 27.90% patients in our study were aged below 50 years.

Table-2 shows results of distribution of study population according to their basal metabolic index (BMI) in study group (n= 86), 32 (37.20%) were overweight and 28 (32.55%) were obese, while only 24(27.9%) had normal BMI. Maximum number of patients in study group had BMI in over weight range. The prevalence of obesity (i.e. BMI ≥30 kg/m2) at the time of diagnosis was 32.55%, Nambuya *et al.*, [19] reported a prevalence of 53.5% for over weight in newly diagnosed diabetic patients in Uganda which was higher than our study.

Table-3 results of prevalence of hypertension in newly diagnosed asymptomatic diabetic patients, from table, it was clear that out of 86 asymptomatic newly diagnosed diabetes patients, 18 (20.93%) had stage I hypertension while 8 (9.30%) had stage-II hypertension. Prevalence of hypertension in asymptomatic subjects was 30.23% at the time of diagnosis of diabetes.

Table-4 results of prevalence of neuropathy in newly diagnosed asymptomatic and diabetic patients out of 86 asymptomatic newly diagnosed diabetic subjects, 20 (23.25%) had peripheral neuropathy while only 2 (2.32%) had autonomic neuropathy. Overall prevalence of diabetic neuropathy in asymptomatic group was 25.58%. Prevalence of diabetic neuropathy at the time of diagnosis was higher. The present study highlights that mere absence of symptoms cannot be equated with absence of neuropathy because asymptomatic neuropathy. Diabetic neuropathy was the most common vascular complication present at the time of diagnosis of type 2 diabetes. The prevalence of diabetic neuropathy at the time of diagnosis of type 2 diabetes in our study was high compared to Ratzmann *et al.,* [20] (Peripheral Neuropathy 6.3%, Autonomic Neuropathy 7.3%, overall = 13.6%), Ramchandran *et al.,* (14%) [18] , Thompson *et al* (9%) and. Nambuya *et al.,* [19] had found very high prevalence of diabetic neuropathy (46.4%) in newly diagnosed diabetic patients in Uganda. The prevalence of neuropathy varies according to criteria and methods used to diagnose diabetic neuropathy. In the absence of use of sophisticated electro diagnostic tests, quantitative sensory testing (QST), NCV, quantitative autonomic function testing (QAFT) diabetic neuropathy is grossly under diagnosed.

Table-5 shows results of prevalence of retinopathy in newly diagnosed asymptomatic diabetic patients out of 86 asymptomatic newly diagnosed diabetic patients, 10 (11.62%) had non-proliferative diabetic retinopathy while none of patients had proliferative diabetic retinopathy. Prevalence of diabetic retinopathy in our study was similar to study by Klein *et al*., [22] (10.2%) and Rema *et al.,* [23] in their prevalence of retinopathy in newly diagnosed type 2 diabetes patients using both clinical examination and retinal photography was 7.9%, which included 6.9% early BDR and 1% with maculopathy, while none had proliferative diabetic retinopathy. The prevalence of retinopathy in our study is lower than western studies (20% by Thompson *et al.,* [21] and 20.8% by Harris *et al.,* [24]. This may be due to lesser sensitivity of examination (fundus alone) used in our study. Hence further studies with use of more sensitive methods (eg. Retinal fluorescein angiography) are required from different parts of India to know the exact prevalence of retinopathy.

Table-6 shows the results of prevalence of nephropathy in newly diagnosed asymptomatic diabetic patients Out of 86 asymptomatic newly diagnosed diabetic patients, 12 (13.95%) had microalbuminuria while 4 (4.65%) had overt nephropathy as evidenced by macroalbuminuria. Thus the prevalence of diabetic nephropathy in study group was 18.60%. The prevalence of nephropathy in our study was similar to study by Ramachandran *et al.,* [18] done in South India (16.2%) and lower than western study by Cathelineau *et al.,* (30%) [25] and Annemieke *et al* (26.7% in general practice) [26] .

Based on the Table 7 & 8 the results of smoking and alcoholism as a risk factor of occurrence of vascular complications in diabetic subjects. The age as a risk factor shows that out of 86 patients, 56 are in the age group between 50-70 yrs. Most of the patients who are in the study group are above the age of 60 years. So it can be concluded that age is a definite risk factor for the development of vascular complications. Out of 56 patients in study group 10 (17.85%) patients are alchoholic and out of 30 patients in control group only 6 (20%) patients are alchoholic. P value is 0.078 which is statistically insignificant. So the relation between alchoholism and occurrence of vascular complication is insignificant.

## CONCLUSION

Type 2 diabetes is characterized by a long asymptomatic period before it is diagnosed. And by the time it is diagnosed, a large proportion of patients have already developed various micro and macrovascular complications in various stages. ADA recommends screening of all asymptomatic adults aged >45 years and earlier if one or more additional risk factor for diabetes (family history of diabetes, overweight, previous IFG or IGT, hypertension, dyslipidemia, history of CVA, history of GDM etc.) are present and thereafter every 3 years[23] while no such screening program exists in India. At the same time once the diabetes has been diagnosed, other associated risk factors which can increase the occurrence and progression of vascular complications should be looked for. In our study the results shows significant association of these risk factors in Type 2 diabetes and was treated as early as possible to decrease the progression of vascular complications. However, due to relatively small sample size of our study, further elaborate study in general population is required, not only to substantiate the findings of present study but also to test various screening methods in relation to various risk factors for timely detection of undiagnosed Diabetes cases in our country.

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