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RESEARCH ARTICLE

TO STUDY THE PREVALENCE OF MICROVASCULAR COMPLICATIONS IN TYPE 2 DIABETES MELLITUS PATIENTS

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Abstract

Duration of diabetes and BMI is directly proportional to these complications. Family history of diabetes influence the micro vascular complications. Prevalence was found significantly higher in patients whose both parents and sibling are suffering from diabetes. Retinopathy and neuropathy were the most prevalent microvascular complication in type 2 diabetic population.

Introduction:-

The incidence of diabetes mellitus (DM) is increasing substantially worldwide. Over the past three decades, the global burden of DM has swelled from 30 million in 1985 to 382 million in 2014, with current trends indicating that these rates will only continue to rise.[1] The latest estimates by the international diabetes federation project that 592 million (1 in 10 persons) worldwide will have DM by 2035.[2] While the rates of both type 1 DM (T1DM) and T2DM are growing, T2DM has a disproportionately greater contribution to the rising prevalence of DM globally compared to T1DM.[3] One consequence of the growing rates of DM is a considerable economic burden both for the patient and the healthcare system. In the United States, the total cost of DM averages $2108/patient per year, which is nearly twice that of non-diabetic patients. The economic burden associated with DM is substantial both in terms of the direct costs of medical care as well as indirect costs of diminished productivity tied to diabetes related morbidity and mortality. The direct costs of DM are primarily attributed to both macrovascular and microvascular complications such as coronary artery disease, myocardial infarction, hypertension, peripheral vascular disease, retinopathy, end-stage renal disease and neuropathy.

The pathologic hallmark of DM involves the vasculature leading to both microvascular and macrovascular complications.[4] Chronicity of hyperglycemia is associated with long-term damage and failure of various organ systems mainly affecting the eyes, nerves, kidneys, and the heart.[5]

According to diabetes atlas (7th edition), the global prevalence of diabetes is estimated at 415 million (8.8%), which is predicted to rise to 642 million in next 25 years. In India, there are about 69.2 million people with diabetes and are expected to cross 123.5 million by 2040.[6] Moreover, worldwide approximately 193 million diabetics remain undiagnosed predisposing them to the development of several long-term complications of untreated chronic hyperglycemia. Although intensive glycemic control lowers the incidence and progression of microvascular complications, the morbidity associated with these complications is still increasing.[7] Several landmark studies such as the United Kingdom Prospective Diabetes Study (UKPDS) have demonstrated that strict glycemic control does limit microvascular

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disease while attempts to improve macrovascular outcomes through glucose-lowering interventions still remain shrouded with controversy.

Epidemiologic study has shown a fifth of all diabetes patients suffer from two or more micro vascular complications. The complications give rise to morbidity and compromise the quality of life for diabetic subjects.[8] Long-term complications of diabetes include retinopathy with potential loss of vision; nephropathy leading to renal failure; peripheral neuropathy with risk of foot ulcers, amputations, and Charcot joints; and autonomic neuropathy causing gastrointestinal, genitourinary, and cardiovascular symptoms and sexual dysfunction.[9]

It is well-recognized that vascular complications in a given tissue are often accompanied by evidence of pathology in other vascular territories. A linear relationship between microvascular complications and duration of disease was established by the authors where they documented the presence of microvasculopathy across different age groups in their study in 25–40% of diabetic patients aged >25 years with more than 5 years duration of diabetes.[10] Researchers such as Krentz et al. and Al-Wakeel et al. have observed that both microvascular and macrovascular complications develop simultaneously in diabetes.[11,12]

The American Diabetes Association (ADA) has designated HbA1C level of <7% as a target to control blood glucose and International Diabetes Federation (IDF) has designated HbA1c of <6.5% for optimal blood glucose control. According to United Kingdom Prospective Diabetes Study (UKPDS) and Kumamoto study, risk of microvascular complications can be lowered after achieving adequate glycemic control. Similarly, a hypertensive subgroup analyzed in the UKPDS showed adequate control of blood pressure improves the outcome of both macrovascular and microvascular complications. At the age of 45, around 40% of subjects with type 2 diabetes are hypertensive, the proportion increasing to 60% by the age of with the holistic approach, these complications can be controlled leading to reduction in morbidity, mortality and healthcare costs.[13,14]

Intensive glucose control may also slow the progression of early stage complications but recent data suggest that reversing the tissue damage associated with more established microvascular complications is more difficult. The early detection of these complications is important, because it allows for early treatment and the prevention of disease progression. Primary care teams are assuming a greater role in diabetes management. Recent clinical trials in both T1DM and T2DM have highlighted the importance of achieving optimal glucose control as soon as possible after diagnosis and maintaining it for as long as possible. This approach is believed to result in a 'legacy benefit', whereby the protective benefits of early optimal glucose control continue to be seen later in the disease even if glucose control deteriorates over time. Primary care teams also have a pivotal role in ensuring that effective screening takes place to detect microvascular complications at a more treatable stage. Annual retinal screening with timely referral for ophthalmic assessment and treatment, screening for microalbuminuria and the early use of an ACE inhibitor or angiotensin receptor blocker (ARB) where the albumin creatinine ratio (ACR) is persistently raised, and assessment for neuropathy using a 10-g filament to identify patients at increased risk for foot ulcers are key aspects of screening for microvascular complications.

Careful screening for these complications provides clinicians with opportunities to reduce the risk for their development and progression. Aggressive interventions with glycemic control, as well as management of lipids and blood pressure, seem to have favorable effects on many complications of diabetes.

Hence the present study was done at our tertiary care centre to assess the prevalence of microvascular complications in in T2DM patients and correlation of microvascular complications with duration of diabetes.

Indian Scenario

The first national study on the prevalence of type 2 diabetes in India was done between 1972 and 1975 by the Indian Council Medical Research (ICMR-New Delhi).[22] An Urban diabetes survey was done High prevalence of diabetes in an urban population in south India. A National Rural Diabetes Survey was done between 1989 and 1991 in different parts of the country's rural populations which showed diabetic prevalence as 2.8 percent. The prevalence of 6.1 percent in individuals aged above 40 years was unexpectedly high at that time for rural area with low socio-economic status and decreased health awareness. In Kashmir valley, a cross-sectional population survey was done in 2000 and the prevalence of 'known diabetes' was 1.9 per cent among adults aged >40 years. In The National Urban Diabetes Survey (NUDS), a population based study was conducted in six metropolitan (Delhi, Mumbai, Kolkata, Chennai, Hyderabad, Bangalore) cities across India and recruited 11,216 subjects aged 20 years and above, representative of all

socio-economic strata. This study reported the age standardized prevalence of type 2 diabetes as 12.1%. Another study conducted in western India showed age-standardized prevalence of 8.6 per cent in urban population. The Amrita Diabetes and Endocrine Population Survey (ADEPS), a community based cross-sectional survey done in urban areas of Ernakulum district in Kerala has revealed a very high prevalence of 19.5 per cent. Prevalence of Diabetes in India Study (PODIS). A multicentre cross sectional population survey was undertaken to determine the prevalence of diabetes mellitus and impaired glucose tolerance in subjects aged 25 years and above in 77 centers (40 urban and 37 rural) across India . A total of 18363 (9008 males and 9355 females) subjects were studied. 10617 (5379 males and 5238 females) were from urban areas and 7746 (3629 males and 4117 females) from rural areas. The prevalence rate for DM in the total Indian, urban and rural populations was 4.3, 5.9 and 2.7%, respectively. The corresponding IGT rates in the three populations were 5.2, 6.3 and 3.7%, respectively. The urban prevalence of DM and IGT was significantly greater in this study than in the rural population ($P < 0.001$ in both instances). The prevalence of DM was significantly, more than that of IGT ($P < 0.001$) within both the rural and urban populations. The latest estimates of the prevalence of diabetes in the year 2010 by Shah et al.[23] were accepted by United Nations and published by International Diabetic Federation (IDF). Estimating more than 50 million people having diabetes in India in 2010, 68 million by ICMR, INDAB study in 2013 and slated to increase to more than 87 million by 2030 if the preventive measures were not taken to combat this menace.

Prevalence

The global increase in the prevalence of diabetes is due to population growth, aging, urbanisation and an increase of obesity and physical inactivity. The primary determinants of the epidemic are the rapid epidemiological transition associated with changes in dietary patterns and decreased physical activity. Unlike in the West, where older populations are most affected, the burden of diabetes in Asian countries is disproportionately high in young to middle-aged adults. This could have long lasting adverse effects on a nation's health and economy, especially for developing countries. Healthcare expenditures on diabetes are expected to account for 11.6% of the total healthcare expenditure in the world in 2010. Estimated global healthcare expenditures to treat and prevent diabetes and its complications are expected to be at least 376 billion U.S. Dollars (USD) in 2010. By 2030, this number is projected to exceed some USD490 billion.[24]

The "Top 10" countries in the world, in terms of the number of people with diabetes, for 2010 and 2030, are shown in Table 1. At both time points, the three countries with the largest number of people with diabetes are India, China and the U.S. This picture is likely to change soon, in light of the recent escalation in prevalence of diabetes (92.4 million adults) in China.[25] Roughly 80% of people with diabetes are in developing countries, of which India and China share the larger contribution. It is estimated that the total number of people with diabetes in 2010 to be around 50.8 million in India, rising to 87.0 million by 2030.

Top 10 countries for estimated numbers of adults with diabetes, 2010 and 2030

Rank	**Country / Territory**	**2010 (million)**	**Country / Territory**	**2030 (millions)**
1	India	50.8	India	87.0
2	China	43.2	China	62.6
3	U.S.	26.8	U.S.	36.0
4	Russian federation	9.6	Pakistan	13.8
5	Brazil	7.6	Brazil	12.7
6	Germany	7.5	Indonesia	12.0
7	Pakistan	7.1	Mexico	11.9
8	Japan	7.1	Bangladesh	10.4
9	Indonesia	7.0	Russian federation	10.3
10	Mexico	6.8	Egypt	8.6

According to the World Health Organization criteria, the prevalence of known diabetes was 5.6% and 2.7% among urban and rural areas, respectively.

The increased number of diabetics in India is likely to be due to a significant increase in the incidence of type 2 diabetes, caused by unprecedented rates of urbanization, which results in environmental and lifestyle changes. According to World Health Organization (WHO) estimates, the urban population in developing regions will increase

from 1.9 billion in 2000 to 3.9 billion in 2030. It is estimated that by 2030 nearly 46% of India's population will be living in urban areas. Chronic diseases, such as diabetes and cardiovascular disease, pose a primary challenge for the health care system.

India is the second most populous country, with considerable diversity in caste, religion, habitat, socioeconomic status, lifestyle, and food habits. Although several infectious and parasitic diseases have been controlled successfully in India, the non-communicable diseases are becoming increasingly common, resulting in an enormous burden on the health care system. Quite significant economic improvements have occurred in India, but the large population creates difficulties for the effective reduction of poverty, malnutrition, and the provision of health care to all.

India, China, and Pakistan contribute 21%, 12%, and 5%, respectively, to the annual increase in the global population.

A multicenter epidemiological study performed by Indian Council of Medical Research (ICMR) in the early 1970s reported that the prevalence of diabetes in the urban and rural populations ≥ 14 years of age was 2.3% and 1.5%, respectively.

Since then, over the period 1971–2000, studies from different parts of India have reported a 10-fold increase in the incidence of diabetes in the urban area (from 1.2% in 1971 to 12.1% in 2000). Ramachandran et al.[26] reported that age-standardized prevalence of diabetes and impaired glucose tolerance in urban India in 2000 were 12.1% and 14.0%, respectively, with no gender difference. More recent reports from various parts of India showed further increases in diabetes prevalence in urban areas.

Although WHO criteria for the diagnosis and classification of diabetes[27] had been in use since 1980, many of these reports are not strictly comparable owing to variations in sample selection, diagnostic criteria, and differences in the age of the people screened. A series of epidemiological studies performed in Chennai, southern India, showed an increasing prevalence of diabetes and impaired glucose tolerance(IGT). This trend was considered to be a phenomenon of the urban environment because many studies showed wide urban–rural differences. Studies over the period 1990–2000, using standardized WHO or American Diabetes Association (ADA) criteria have demonstrated that the prevalence of diabetes in India has increased from 5% to 15% among urban populations, from 4.2% to 6.2% in semi- urban populations, and from 2% to 5% in rural populations, with wide regional disparities related to urban and rural settings.[28]

ADA 2010 Criteria for the diagnosis of diabetes:[52]

1. HbA1c ≥6.5%. The test should be performed in a laboratory using a method that is NGSP certified and standardized to the DCCT assay.* OR
2. FPG ≥126 mg/dl (7.0 mmol/l). Fasting is defined as no caloric intake for at least 8 h.* OR
3. 2-hr plasma glucose ≥200 mg/dl (11.1 mmol/l) during an OGTT. The test should be performed as described by the World Health Organization, using a glucose load containing the equivalent of 75 g anhydrous glucose dissolved in water.*OR
4. In a patient with classic symptoms of hyperglycemia or hyperglycemic crisis, a random plasma glucose ≥200 mg/dl (11.1 mmol/l). *In the absence of unequivocal hyperglycemia, criteria 1–3 should be confirmed by repeat testing.

Pathophysiological Basis of Micro Versus Macrovascular Complications

Patients with DM and associated microvascular complications appear particularly at higher risk of accelerated atherosclerosis which ultimately culminates in cerebrovascular and cardiovascular events and premature death. Microvessels are the basic functional unit of the cardiovascular system comprising of arterioles, capillaries, and venules.[54] They differ from macrovessels in both their architecture and cellular components. In contrast to macrovessels supplying blood to organs, microvessels play important roles in maintaining blood pressure and proper nutrient delivery. The microcirculation also has regulatory systems controlling vascular permeability and myogenic responses that can adapt blood flow according to local metabolic needs. Alteration in microvascular function may arise even before overt hyperglycemia and vascular pathologic changes manifest. Diabetes induces pathognomonic changes in the microvasculature, affecting the capillary basement membrane including arterioles in the glomeruli, retina, myocardium, skin, and muscle, by increasing their thickness, leading to the development of diabetic microangiopathy. This thickening eventually leads to abnormality in vessel function, inducing multiple clinical problems such as hypertension, delayed wound healing, and tissue hypoxia. Similarly, neovascularization arising

from the vasa vasorum may interconnect macro-and microangiopathy, predict platelet rupture and promote atherosclerosis. The role of microvascular pathology in systemic diabetic complications, including macrovascular atherosclerosis, remains a subject for further debate.[4]

Retinopathy

The diagnosis of retinopathy is based on the findings of eye exams to determine if the patient has clinically significant macular edema, proliferative retinopathy, or severe nonproliferative retinopathy. The progressive changes in the retina that occur in patients with diabetes include the following:

1. Formation of retinal capillary microaneurysms;
2. Development of abnormal vascular permeability;
3. Ischemia;
4. New vessel and fibrous tissue proliferation of the surface of the retina and optic disk;
5. Contraction of the fibrovascular proliferations and the vitreous.[83]

Nephropathy

The diagnosis of nephropathy is initially based on development of microalbuminuria. Microalbuminuria is defined as an albumin excretion rate 20 to 200 mcg/min. Because the average daily albumin excretion rate varies by up to 40% between those with diabetes and those without, it is recommended that three urine collections be taken over several weeks before making this diagnosis. Overt nephropathy is defined as an albumin excretion rate >300 mg/24 hours. This is associated with a linear decline in GFR ranging from 0.1 to 2.4 mL/min/month.

The following are the stages of chronic kidney disease:[84]

1. Stage 1: GFR >90 mg/24 hours.
2. Stage 2: GFR is mildly decreased at 60 to 89 mg/24 hours.
3. Stage 3: GFR is 30 to 59 mg/24 hours.
4. Stage 4: GFR is 15 to 29 mg/24 hours.
5. Stage 5: End-stage nephropathy with a GFR <15 mg/24 hours.

Neuropathy

The diagnosis of neuropathy, defined by loss of ankle jerk reflexes, is based on finding focal (individual root) or diffuse (entire limb) involvement. Findings can be asymmetric (mononeuritis multiplex) or symmetric conforming to a distal-to-proximal gradient of involvement (most common). Electrodiagnostic studies can confirm peripheral nerve disease and define the pattern of disease. Autonomic neuropathy is diagnosed in patients with gastroparesis or orthostatic hypotension.

Goals of medical-nutrition therapy for patients with diabetes.
Achieve optimal metabolic outcomes by attaining and maintaining the following: Blood glucose levels in the normal range or as close to normal as is safely possible Lipid and lipoprotein profiles that reduce risk for macrovascular disease Blood pressure levels that reduce risk for vascular disease Modify nutrient intake and lifestyle as appropriate to prevent and treat obesity, dyslipidemia, CVD, hypertension, and nephropathy Improve health through healthy food choices and physical activity. Address individual nutritional needs, taking into consideration personal and cultural preferences and lifestyle while respecting the individual's wishes and willingness.
Specific patient populations
Children and adolescents with type 1 DM
Provide adequate energy to ensure normal growth and development. Integrate insulin regimens into usual eating and physical activity habits.
Children and adolescents with type 2 DM
Facilitate changes in eating and physical activity habits that reduce insulin resistance and improve metabolic status.
Pregnant and lactating women
Provide adequate energy and nutrients needed for optimal outcomes.
Older adults
Provide for the nutritional and psychosocial needs of aging adults.

Patients treated with insulin or insulin secretagogues
Provide self-management education for treatment (and prevention) of hypoglycemia, acute illnesses, and exercise-related blood glucose problems.
Population at risk for diabetes
Decrease risk by encouraging physical activity and promoting food choices that facilitate moderate weight loss or at least prevent weight gain.

Source: Bantle JP Diabetes Care 2006.[85]

Aims and Objectives:-

1. To study the prevalence of microvascular complications (neuropathy /nephropathy/ retinopathy) in type 2 DM Patients
2. Correlation of microvascular complications (neuropathy/ nephropathy /retinopathy) with duration of diabetes in patients with type2 DM.

Material and Methods:-

A hospital based observational study was conducted with 200 patients to study the prevalence of microvascular complications in type 2 diabetes mellitus patients.

Study design:
A hospital based observational study

Study Duration:
18 months

Study area:
The study was done at our tertiary care centre in the department of General medicine, Northern Railway Central Hospital, New Delhi on attending OPD/IPD patients.

Study population:
All Type 2 DM Patients (ADA1 criteria) with microvascular complications attending OPD/IPD of Tertiary care Hospital in the department of General medicine, Northern Railway Central Hospital, New Delhi who fulfilled the inclusion criteria.

Sample size:
200 patients

Formula used for Sample size calculation was:
$N = (Z^2 \times P \times (1 - P))/d^2$
Z^2= table value of alpha error from Standard Normal Distribution table = 1.96*1.96=3.84 Power (P) = 0.05
(1-P) =0.95
Precision error of estimation (d) = 3% $d^2 = 0.0009$
$N = (3.84 \times 0.05 \times 0.95)/0.0009 = 198.67$
Hence 200 patients was enrolled in the study.

Inclusion criteria:
1. Type 2 DM Patients (ADA1 criteria)
2. Age >20 years
3. Non pregnant females

According to ADA1 criteria for diagnosis are:
1. Glycosylated hemoglobin (HbA1C) ≥6.5%. OR
2. Fasting plasma glucose ≥126 mg/dL (7.0 mmol/L). or
3. 2-hour plasma glucose ≥200 mg/dL (11.1 mmol/L) during an OGTT (oral glucose tolerance test) OR
4. In a patient with classic symptoms of hyperglycemia or hyperglycemic crisis, a random plasma glucose≥200 mg/dL (11.1 mmol/L).

Exclusion Criteria

1. Type 1 diabetes mellitus
2. Refusal to be a part of the study
3. Pregnancy
4. Age <20 years
5. On ayurvedic / homeopathic or other forms of medicine
6. Patients having severe comorbidities
7. Ocular hazy media or patients undergone pan photocoagulation therapy.

Methodology:-

The study was done at our tertiary care centre in the department of General medicine, Northern Railway Central Hospital, New Delhi, India, a multispecialty hospital, central government of India undertaking on attending OPD/IPD after due permission from the Institutional Ethics Committee and Review Board and after taking Written Informed Consent from the patients.

After approval from the Institutional Ethics Committee a valid informed consent was taken. Once the patients were enrolled for the study, a thorough history and physical examination was done as per proforma. An informed consent was taken in written from patients or patient's attendant.

Materials:-

A Routine investigation was done of all patients as per hospital protocol in a cost effective criteria which was mentioned below:

1. Complete Blood Count –by Automated Counter (BECKMAN COUNTER)
2. Kidney Function Tests, Liver Function Tests, Fasting and PP Blood Sugars, lipid profile–by Fully Automated Biochemical Analyser. (OLYMPUS AU400)
3. Urine for routine microscopy –by Dipstick method and Microscopy.
4. USG Abdomen -PHILIPS HD11XE USG machine
5. HBAIC-daytona auto analysis which is expressed in %

Summary:-

A hospital based observational study was conducted with 200 patients to study the prevalence of microvascular complications in type 2 diabetes mellitus patients. The following observations were noted:

1. Majority of the patients (22.5%) were from the age group of 41-50 years followed by 20.5% from the age group of 31-40 years, 17% from the age group of 61-70 years, 16% from the age group of 51-60 years, 14% from the age group of 71-80 years and 10% from the age group of 21-30 years. The mean age of patients was 50.86 ± 15.91 years.
2. There were 116 (58%) male patients while female patients constituted 42% of the study population.
3. 6 (3%) patients were underweight while 48 (24%) patients had BMI in the normal range. 76 (38%) and 70 (35%) patients were overweight and obese respectively. The mean BMI of patients was 26.92 ± 4.34 kg/m^2.
4. The mean waist hip ratio for male and female patients was 0.96 ± 0.06 and 0.99 ± 0.06 respectively. There was no statistically significant difference between the groups as per Student t-test ($p>0.05$).
5. 41 (20.5%) patients had diabetes for <5 years while 55 (27.5%) and 104 (52%) patients had diabetes for 5-10 years and >10 years respectively. The mean duration of diabetes was 9.92 ± 4.90 years.
6. 141 (70.5%) patients had family history of diabetes while 59 (29.5%) patients did not have family history of diabetes.
7. 53 (26.5%) patients were smokers.
8. 14 (7%) patients had history of drinking alcohol.
9. 117 (58.5%) patients had hypertension while 35 (17.5%) patients had Ischemic Heart Disease respectively.
10. The mean Fasting Blood Sugar (FBS) of patients was 190.05±27.69 mg/dl while the mean Postprandial Blood Sugar (PPBS) of patients was 287.05±39.13 mg/dl.
11. 27 (13.5%) patients had HbA1c <7 (good glycemic control) while 173 (86.5%) patients had HbA1c ≥7 (poor glycemic control). The mean HbA1c level of patients was 8.46 ± 1.02%.
12. The mean creatinine and urea levels of patients was 0.89±0.08 mg/dl and 24.20±6.06 mg/dl respectively while

the mean total bilirubin and serum albumin levels of patients was 1.66±2.59 mg/dl and 3.48±0.99 mg/dl respectively.

13. The mean cholesterol and HDL levels of patients was 170.05±26.88 mg/dl and 61.07±10.83 mg/dl respectively while the mean LDL and triglyceride levels of patients was 80.69±15.02 mg/dl and 111.80±24.24 mg/dl respectively.
14. 80 (40%) patients had diabetic nephropathy while 56 (28%) and 48 (24%) patients had diabetic retinopathy and diabetic neuropathy respectively.
15. Majority of patients with diabetic nephropathy (9%) were in the age group of 41-50 years while majority of the patients with diabetic retinopathy and diabetic neuropathy were in the age group of 41-50 years and 61-70 years respectively. There was no significant correlation of microvascular complications and age of patients as per Chi- Square test ($p>0.05$).
16. Majority of male patients had diabetic nephropathy (27%) while majority of the female patients had diabetic retinopathy (16%). There was no significant correlation of microvascular complications and gender of patients as per Chi-Square test ($p>0.05$).
17. The incidence of diabetic nephropathy (17.5%), retinopathy (10.5%) and neuropathy (12%) were significantly higher among patients with duration of diabetes >10 years compared to patients with duration of diabetes <5 years and 5-10 years. There was significant correlation of microvascular complications and duration of diabetes of patients as per Chi-Square test (**$p<0.05$**).
18. The incidence of nephropathy (34.5%), retinopathy (23.5%) and neuropathy (20.5%) was significantly higher in patients who had HbA1c≥7%. There was significant correlation of microvascular complications and HbA1c in patients as per Chi-Square test (**$p<0.05$**).

Conclusion:-

Duration of diabetes and BMI is directly proportional to these complications. Family history of diabetes influence the micro vascular complications. Prevalence was found significantly higher in patients whose both parents and sibling are suffering from diabetes. Retinopathy and neuropathy were the most prevalent microvascular complication in type 2 diabetic population.

HbA1C levels predict the prevalence of complications and there is moderate correlation between HbA1C and blood glucose levels. Thus the screening for the complications of Diabetic patients is very useful in the preventive management of disease. Screening with simple tests such as Fundoscopy and urine Microalbuminuria at diagnosis for all cases of diabetes, is essential to identify the complications at an early reversible stage.