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Original Research Article

Study the Correlation Between the Indian Diabetes Risk Score (IDRS) Value and Microvascular Complications in Newly Diagnosed Type 2 Diabetes Mellitus

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ABSTRACT

Background

The initiation of type-2 diabetes mellitus (T2DM) is frequently asymptomatic and gradual. One reason newly diagnosed type-2 diabetes mellitus patients have a higher risk of microvascular problems is untreated long-standing hyperglycemia. The objective of our study was to evaluate the frequency of microvascular problems in recently diagnosed patients with type 2 diabetes mellitus at a tertiary care hospital in India.

Material and Methods: A cross-sectional study was undertaken in the medicine department of a tertiary care hospital. The study included a cohort of 100 patients who were recently diagnosed with type 2 diabetes mellitus. Microvascular complications were diagnosed after a thorough study of the patient's medical history, clinical assessment, and pertinent diagnostic tests.

Results: Subjects who had an IDRS score of 60 or higher showed a higher occurrence of peripheral neuropathy (86.5% vs 13.5%, p=0.371), retinopathy (91.7% vs 8.3%, p=0.157), and nephropathy (77.8% vs 22.2%, p=0.410) compared to subjects with an IDRS score below 60.

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However, there was no statistically significant difference in the occurrence of microvascular problems between the two IDRS subgroups. Those diagnosed with nephropathy exhibit a statistically significant higher average IDRS score compared to those without nephropathy (65.00±17.32 vs 62.66±12.50, p-value = 0.037). However, no statistically significant difference was detected in the mean values of the IDRS scores of the other two microvascular complications.

Conclusion: IDRS is a valuable tool for predicting newly diagnosed type 2 diabetes mellitus. However, further large, multi-centric studies will be required to detect its usefulness in microvascular complications.

Keywords: Type 2 diabetes mellitus, microvascular complications, nephropathy, neuropathy, retinopathy, Indian Diabetes Risk Score

Study Resign: Observational study

1. INTRODUCTION

The global occurrence of diabetes is estimated to rise from 4% in 1995 to 5.4% by 2025.[1] It was estimated that in 2017, 451 million people had diabetes, and the number was expected to increase to 693 million by 2045.[2] The estimates in India showed that 101 million people had diabetes in 2019, and the population was expected to rise to 134 million in 2045.[3,4] In developing nations, the majority of patients are in the 45-64 age group, while in developed countries, the age group is 65.[5]

Type 2 diabetes mellitus often develops gradually, and it can be many years before a diagnosis is made. There is an asymptomatic period between the initiation of diabetic hyperglycemia and clinical diagnosis. It is estimated that this asymptomatic period lasts between four and seven years, and 30 to 50 % of patients stays untreated.[6]

Microvascular complications resulting from T2DM are prevalent. One of the causes of retinopathy leads to varying degrees of visual impairment, and blindness worldwide is significantly caused by it.[7] Another microvascular complication – neuropathy, leads to pain and numbness and causes chronic and recurrent infected ulcers in limbs.[8] Nephropathy, which was identified by proteinuria, leads to end-stage renal disease.[9] It is one of the primary causes of end-stage renal disease.[9]

Several international associations and federations have created risk score systems to assess the likelihood of developing type 2 diabetes mellitus. Among the prediction tools mentioned are the American Diabetes Association Risk Tools, Finnish Diabetes Risk Score, National Health and Nutrition Examination Survey risk score, and the study to prevent non-insulin dependent diabetes mellitus (DM) risk score. These tools have been developed and are currently being used in developed countries and India. The Indian Diabetes Risk Score (IDRS), established by the Madras Diabetes Research Foundation (MDRF) and Ramachandran et al., is commonly utilised.[10]

2. MATERIAL AND METHODS

This cross-sectional study was undertaken in the Department of General Medicine to observe and collect data, Mahatma Gandhi Medical College, Jaipur, Rajasthan. The study sample comprised 100 diabetic patients attending OPD or getting admitted to Mahatma Gandhi Medical College, Jaipur, Rajasthan. Patients with recently diagnosed diabetes who met the

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inclusion and exclusion criteria were included in this study. The parents who were enrolled in the study gave written informed consent and were monitored.

Sample Size

The calculation suggested a sample size of 94. We are recruiting 100 patients for the study.

Study Period

September 2022 and March 2024

Inclusion Criteria

1.Diagnosis procedures and standards diabetes mellitus (WHO criteria)

a. Symptoms of diabetes (i.e., polyuria, polydipsia and unexplained weight loss) together with a random venous plasma glucose concentration more than 11.1 mmol/l (more than 200mg/dl)

b. A fasting plasma glucose concentration greater than 7.0 mmol/l (greater than 126 mg/dl)

c. A plasma glucose concentration exceeding 11.1 mmol/l (greater than 200mg/dl) two hours after consuming 75g anhydrous glucose in an oral glucose tolerance test (OGTT).

2.Age > 40 years

Exclusion Criteria

1. Type 1 diabetes mellitus
2. Pregnant and gestational diabetes mellitus
3. Patient on angiotensin-converting enzyme (ACE)/angiotensin receptor blocker (ARB) inhibitor
4. Serum creatinine > 2 mg/dl
5. Other causes of neuropathy
6. Patient with urinary tract infection
7. Patients are not willing to participate.

Sampling Technique

Indian Diabetes Risk Score (IDRS)

Each individual's score was computed based on factors such as age, physical activity, family history, and abdominal obesity. The maximum score is 100, and the minimum is 0.

Sr No	Particulars	Score
	Age (yr)	
1	<35	0
2	35-49	20
3	>50	30
	Abdominal Obesity	
1	Waist<80 cm (female), <90(male)	0
2	Waist>80-89 cm (female), >90-99 (male)	10
3	Waist >90 cm (female), >100 (male)	20
	Physical Activity	
1	Vigorous exercise or strenuous (manual)	0
2	Mild to moderate exercise or mild to moderate physical activity at home/work	20
3	No exercise and sedentary activities	30
	Family History	
1	No family history (reference)	0

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2	Either parent	10
3	Both parents	20

Interpretation:
Score > 60 high risk for Type2 Diabetes Mellitus.

Neuropathy Disability Score (NDS):

Neuropathy Disability Score (NDS)

		Right	Left
Vibration perception threshold 128 Hz tuning fork; apex of big toe; trial pair = vibrating, non-vibrating (hit the wrong end of the tuning fork); normal = can distinguish vibrating / not vibrating	Subject sitting, eyes closed, legs outstretched: demonstrate on clavicle or dorsum of hand; in each case repeat three pairs of trials (mix up stimulus order within trial pair, in each case maintain stimulus 2 seconds); in each case ask "do you feel vibration / cold / sharp now or now?"; abnormal is at least two of three trials wrong or "cannot tell" normal = 0 abnormal = 1		
Temperature perception Rest Tip-Therm rod on dorsum of foot, trial pair = plastic end ("not cold"), metal end ("cold"); normal = can distinguish cold / not cold			
Pin-prick Apply Neurotip on proximal big toe just enough to deform skin; trial pair = sharp end, blunt end; normal = can distinguish sharp / not sharp			
Achilles reflex Kneeling on a chair, upright holding back of chair; stretch tendon to ankle neutral first; reinforcement – hook fingers together and pull when asked	present = 0 present with reinforcement = 1 absent = 2		
NDS Total out of 10			

Interpretation:
A score>2 is considered to be the presence of neuropathy.

Eye Examination (By Ophthalmologist) by using indirect ophthalmoscope and slit lamp biomicroscopy:

Individuals with normal fundus were distinguished from individuals with diabetic retinopathy (either non-proliferative or proliferative diabetic retinopathy).

Laboratory Investigations:

Serum creatinine and urine microalbumin (morning urine spot sample), random blood glucose, fasting plasma glucose, and glycated haemoglobin (HbA1C).

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Morning Urine Spot Collection:
Any urine albumin greater than 30 mg/g is deemed abnormal. A creatinine level of 30 to 300 mg/g is considered indicative of early diabetic nephropathy. Over 300 mg/g of creatinine is indicative of diabetic nephropathy.

Statistical Analysis
Data was updated over the three-month evaluation process and concurrently entered into proforma. A master chart was created when it was put into Microsoft Excel (MS Office 365). The SPSS program, version 25.0, was used to analyse the data. A statistical analysis of data was conducted among groups.

- Age categories, which fall under nominal data, were displayed as numerical values and percentages.
- Continuous data, such as age and lab values, were represented using the mean, standard deviation, and range.
- The chi-square test was used to compare nominal data.
- A p-value of 0.05 was deemed to have statistical significance. (A 95% confidence interval was considered)

Limitations of the study
Because of the single researcher and time constraints, fewer patients were chosen.
A more significant number of patients may have resulted in a stronger correlation.

3. OBSERVATIONS AND RESULT

Among 100 participants, the mean age was 60.18 ± 11.46 years. The youngest participant was 41 years old, and the oldest was 87 years old. Among participants 56 male and 44 were females.

Table 1: Distribution of patients as per IDRS Score

IDRS	Frequency	Percentage
≥60	82	82%
<60	18	18%
Total	100	100

Most people with diabetes, i.e., 82(82%), had IDRS values equal to or more than 60. Only 18 (25%) had IDRS value below 60.

Table 2: Distribution of patients as per microvascular complications

Sr. No	Microvascular complication	Frequency	Percentage
1	Nephropathy	36	36%
2	Neuropathy	37	37%
3	Retinopathy	24	24%

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The findings suggested that the maximum diabetics 37(37%) were having neuropathy. followed closely by nephropathy in 35(35%). The prevalence of retinopathy was seen in 24 (24%) people with diabetes.

Table 3: Distribution of diabetic patients: IDRS score grade vs neuropathy.

			Peripheral Neuropathy		Total
			No	Yes	
IDRS	<60	N	13	5	18
		%	20.6%	13.5%	18.0%
	≥60	N	50	32	82
		%	79.4%	86.5%	82.0%
Total		N	63	37	100
		%	100.0%	100.0%	100.0%

Pearson chi-square = 0.801 p-value = 0.371

Among patients with peripheral neuropathy, 5 (13.5%) had IDRS score <60, while 32 (86.5%) had IDRS score ≥ 60. Among patients with no peripheral neuropathy, 50 (79.4%) had IDRS Score ≥ 60, while 13 (20.6%) had IDRS Score <60. The difference was not statistically significant(p-value=0.371).

Table 4: Distribution of diabetic patients: IDRS score grade versus retinopathy

			Retinopathy		Total
			No	Yes	
IDRS	<60	N	16	2	18
		%	21.1%	8.3%	18.0%
	≥60	N	60	22	82
		%	78.9%	91.7%	82.0%
Total		N	76	24	100
		%	100.0%	100.0%	100.0%

Pearson chi-square = 1.999 p-value = 0.157

Among patients with retinopathy, 2 (8.3%) had IDRS score <60, while 22 (91.7%) had IDRS score ≥ 60. Among patients with no retinopathy, 50 (79.4%) had IDRS Score ≥ 60, while 13 (20.6%) had IDRS Score <60. The difference was not statistically significant (p-value=0.157).

Table 5: Distribution of diabetic patients: IDRS score grade versus nephropathy

			Nephropathy		
			No	Yes	Total
IDRS	<60	N	10	8	18
		%	15.6%	22.2%	18.0%
	≥60	N	54	28	82
		%	84.4%	77.8%	82.0%
Total		N	64	36	100
		%	100.0%	100.0%	100.0%

Pearson chi-square = 0.679 p-value = 0.410

Among patients with nephropathy, 8 (22.2%) had IDRS score <60, while 28 (77.8%) had IDRS score ≥ 60. Among patients with no nephropathy, 54 (84.4%) had IDRS Score ≥ 60, while 10

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(15.6%) had IDRS Score <60. The difference was not statistically significant (p-value=0.410) .

Table 6: Distribution of diabetic patients: mean values of parameters versus neuropathy

	Peripheral Neuropathy	N	Mean	Std. Deviation	Std. Error Mean	p-Value
IDRS	No	63	63.33	15.554	1.960	0.107
	Yes	37	63.78	12.327	2.027	

Table 6 reveals that the mean Final IDRS Score of the patients with neuropathy was 63.78± 12.33, whereas the mean Final IDRS Score of those without neuropathy was 63.33± 15.55. This difference in means was found statistically non-significant(p-value=0.107)

Table 7: Distribution of diabetic patients: mean values of parameters versus retinopathy

	Retinopathy	N	Mean	Std. Deviation	Std. Error Mean	p-Value
IDRS	No	76	62.11	15.346	1.760	0.084
	Yes	24	67.92	9.771	1.994	

Table 7 reveals that the mean Final IDRS Score of the patients with retinopathy was 67.92± 9.78, whereas the mean Final IDRS Score of those without retinopathy was 62.11± 15.35. This difference in means was found statistically non-significant(p-value=0.084)

Table 8: Distribution of diabetic patients: mean values of parameters versus nephropathy

	Nephropathy	N	Mean	Std. Deviation	Std. Error Mean	p-value
IDRS	No	64	62.66	12.503	1.563	0.037
	Yes	36	65.00	17.321	2.887	

Table 8 reveals the mean Final IDRS Score of the patients with nephropathy was 65.00± 17.32, whereas the mean Final IDRS Score of those without nephropathy was 62.66± 12.50. This difference in means was found statistically significant(p-value=0.037)

4. DISCUSSION

The IDRS has four clinical components: age, family history of type 2 diabetes mellitus, waist circumference, and physical activity. Our study showed that patients with the category of IDRS ≥ 60 had a higher prevalence of neuropathy, retinopathy, and nephropathy, but these values are not statistically significant.

The mean of the IDRS score was also calculated in both groups of patients who were affected and those not affected by neuropathy. In neuropathy, patients affected with neuropathy had mean IDRS 63.78±12.327. Patients not affected by neuropathy had mean IDRS 63.33±15.554. It was not statistically significant, with p=0.107. In retinopathy, patients affected with retinopathy had mean IDRS 67.92±9.771. Patients not affected by retinopathy had mean IDRS 62.11±15.346. It was not statistically significant with p=0.084. In nephropathy, patients affected with nephropathy had mean IDRS 65.00±17.321. Patients not affected by nephropathy had mean IDRS 62.66±12.503. It was statistically significant with p=0.037. It means that

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patients with high IDRS scores have more risk of developing nephropathy compared to those with low IDRS scores in newly diagnosed type 2 patients.
The study by Mohan V et al. showed patients with IDRS≥60 have higher chances of neuropathy and peripheral vascular disease. The odds ratio [OR] for neuropathy was 4.27 (95% CI: 2.74–6.67, p<0.001), and for peripheral vascular disease was 2.57 (95% CI: 1.02-6.46, p=0.045).[11] However, this study didn't enroll just newly diagnosed type 2 diabetes mellitus; its sample size was more than 1000 participants. These two factors are major differences from our study.

5. CONCLUSION

The majority of newly diagnosed type 2 diabetes mellitus patients (82%) had IDRS values more than 60, indicating the usefulness of IDRS in type 2 diabetes mellitus patient screening. In our study, the prevalence of neuropathy was highest, at 37%, followed by nephropathy at 36% and retinopathy at 24%, respectively.
In developing countries like India, the IDRS provides a far more affordable and straightforward method of conducting widespread diabetes screening. Targeted screening for type 2 diabetes in those who have never been diagnosed could help avoid or postpone the emergence of microvascular problems. The IDRS Scores >60 present as high risk of type 2 diabetes mellitus; however, they don't reflect a high risk of microvascular complications in our study. In our study, patients with nephropathy had statistically significant high IDRS Scores compared to patients without nephropathy. It will require further sizeable multi-centric research study.

6. REFERENCES

1. King H, Aubert RE, Herman WH. Global burden of diabetes, 1995–2025: prevalence, numerical estimates, and projections. Diabetes Care. 1998;21(9):1414-1431.
2. Cho NH, Shaw JE, Karuranga S, et al. IDF Diabetes Atlas: Global estimates of diabetes prevalence for 2017 and projections for 2045. Diabetes Res Clin Pract. 2018;138:271-281.
3. Pradeepa R, Mohan V. Epidemiology of type 2 diabetes in India. Indian J Ophthalmol. 2021;69(11):2932.
4. Anjana RM, Unnikrishnan R, Deepa M, et al. Metabolic non-communicable disease health report of India: the ICMR-INDIAB national cross-sectional study (ICMR-INDIAB-17). Lancet Diabetes Endocrinol. Published online 2023.
5. Ramachandran A. Socio-economic burden of diabetes in India. Journal-Association of Physicians of India. 2007;55(L):9.
6. Spijkerman AMW, Dekker JM, Nijpels G, et al. Microvascular complications at time of diagnosis of type 2 diabetes are similar among diabetic patients detected by targeted screening and patients newly diagnosed in general practice: the hoorn screening study. Diabetes Care. 2003;26(9):2604-2608.
7. Balasubramanyam M, Mohan V. Diabetes in 2007–What are the promises & challenges? Indian Journal of Medical Research. 2007;125(3):195-199.
8. Boulton AJM. Diabetic neuropathy and foot complications. Handb Clin Neurol. 2014;126:97-107.
9. Molitch ME, DeFronzo RA, Franz MJ, Keane WF. Nephropathy in diabetes. Diabetes Care. 2004;27:S79.
10. Noble D, Mathur R, Dent T, Meads C, Greenhalgh T. Risk models and scores for type 2 diabetes: systematic review. Bmj. 2011;343.

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE7, 2024

11. Mohan V, Vassy JL, Pradeepa R, Deepa M, Subashini S. The Indian type 2 diabetes risk score also helps identify those at risk of macrovasvular disease and neuropathy (CURES-77). J Assoc Physicians India. 2010;58:430-433.