

Original Research Article

Clinical study of neurological presentation of diabetes mellitus in a tertiary care hospital

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ABSTRACT

Background: A wide range of commotions affecting the central and peripheral nervous systems, either directly or indirectly, may be observed in patients with diabetes mellitus. The spectrum of neurological complications among diabetes are quite varied.

Methods: Authors conducted a Cross-sectional prospective observational study to study different neurological manifestations of diabetes mellitus. at NRI General Hospital, Chinakakani, Guntur District, Andhra Pradesh. The selected patients were studied in detail with history and physical examination. The investigations included Fasting Blood Sugar (FBS), Postprandial Blood Sugar (PPBS), Glycosylated Hemoglobin (HbA1C).

Results: A total of 100 subjects were included in the final analysis. Majority of participants were aged between 46 to 65 years, and 55% of them were males. Only 13% of the participants had HBA1c value below 7.5 gm%. Out of 100 participants, 82% participants had diabetic peripheral neuropathy. A total of 6 subjects had cranial neuropathy, with 5% participants having 3rd nerve and one participant had 6th nerve. Involuntary movements (Chorea) was present in 4% of patients. Among the people with Seizures, 6% participants had Hyperglycemic, and 2% participants had Hypoglycemic seizures. Out of 100 participants, 7 participants had dysautonomia.

Conclusions: Peripheral neuropathy was the most common neurological manifestation among the diabetic population. The other key neurological abnormalities include cranial nerve palsy, dysautonomia, seizures and Chorea. Clinicians need to be aware the entire spectrum of neurological abnormalities among patients with type 2 Diabetes.

Keywords: Diabetes mellitus, Diabetic neuropathy, Dysautonomia, Neurological abnormalities

INTRODUCTION

Diabetes Mellitus (DM) is considered a group of metabolic diseases which is characterized by hyperglycemia that results from defects in insulin secretion, insulin action, or both. The chronic hyperglycemia of diabetes is related with long-term damage, dysfunction, and failure of discrete organs, especially the eyes, kidneys, nerves, heart, and blood vessels as well as also decreases life quality and

expectancy and act as trouble regarding the financial burden for health care systems.^{1,2}

A study estimated that in 2017 there were 451 million (age 18-99 years) people with diabetes globally. They were expected to show a hike at (693 million) by 2045. An estimation revealed that almost half of all people (49.7%) living with diabetes were undiagnosed.³ A study done in 15 Indian states showed the overall prevalence of 7.3%, 1862(47.3%) of 3938 individuals identified as having diabetes were not been diagnosed previously.⁴

Complications of DM increases morbidity, disability, and mortality and poses a threat for the economies of all countries, mainly for the developing nations.⁵

Diabetes mellitus is associated with chronic complications such as nephropathy, angiopathy, retinopathy and peripheral neuropathy.⁶ Generally, the injurious effects of hyperglycemia are separated into macrovascular complications (coronary artery disease, peripheral arterial disease, and stroke) and microvascular complications (diabetic nephropathy, neuropathy, and retinopathy).⁷ As result microvascular involvement of any system or organ can be affected in DM.⁸ Microvascular complications, are a leading cause of blindness, kidney failure, and lower limb amputation.⁹

Diabetic Neuropathy (DN) is a common disorder and is defined as signs and symptoms of peripheral nerve dysfunction in a patient with Diabetes Mellitus (DM) in whom other causes of peripheral nerve dysfunction have been excluded.¹⁰ Diabetic Peripheral Neuropathy (DPN) has been defined by the Toronto Consensus Panel on Diabetic Neuropathy as a “symmetrical, length-dependent sensorimotor polyneuropathy attributable to metabolic and micro vessel alterations as a result of chronic hyperglycemia exposure and cardiovascular risk covariates”.¹¹ Diabetic Peripheral Neuropathy (DPN) is associated with considerable morbidity, mortality and diminished quality of life. Characterized by pain, paresthesia and sensory loss, it affects up to 50% of people with diabetes.¹² A wide range of commotions affecting the central and peripheral nervous systems, either directly or indirectly, may be observed in patients with diabetes mellitus.¹³ The effects of diabetes on the Central Nervous System (CNS) result in cognitive dysfunction and cerebrovascular disease.¹⁴ There is a plethora of literature on diabetes and its management, but there exists dearth in studies majorly focusing on its neurological manifestations. Hence, authors conducted this research with an aim to study different neurological manifestations of diabetes mellitus.

METHODS

Study design was prospective observational study. Study population was patients with diabetes mellitus admitted to Medical Wards and Neurology Wards. Sample size was 100 participant’s cases were interviewed, examined and investigated as per the predesigned proforma. Study duration was the data collection for the study was conducted from September 2016 to October 2018. Study site was the study was conducted in the Department of General Medicine, NRI Medical College and General Hospital, Chinakakani.

Inclusion criteria

- Patients who were known diabetics and also patients who were diagnosed to be diabetic based on WHO criteria for the diagnosis of diabetes mellitus.

Procedure

History, clinical examination findings and investigations of the selected diabetic patients were collected and correlated in the study. The selected patients were studied in detail with history and physical examination. The investigations included Fasting Blood sugar and Postprandial blood sugar, glycosylated hemoglobin. Nerve conduction studies for the patients who were affordable. All the patients were clinically examined as per prefixed proforma and clinical signs recorded.

Ethical approval

The study was approved by the institutional human ethical committee. Informed written consent was obtained from all the participants.

Statistical methods

Descriptive analysis was carried out frequency and proportion for categorical variables. IBM SPSS version 22 was used for statistical analysis.¹⁵

RESULTS

The study had included 100 patients with diabetes mellitus in the final analysis.

Table 1: Baseline demographic characteristics of the study population (N=100).

	Parameter	Number	%
Age	35-45	22	22%
	46-55	26	26%
	56-65	35	35%
	66-75	15	15%
	76-85	2	2%
Sex	Male	55	55%
	Female	45	45%
Duration of diabetes (in years)	0-4	15	15%
	5-9	20	20%
	10-14	38	38%
	>15	27	27%
Family history of diabetes	Present	25	25%
	Absent	75	75%
Comorbid hypertension	Present	35	35%
	Absent	65	65%

Age distribution of participants showed majority of the participants were aged between 45 to 65 years. The proportion of male and female population was 55% and 45% respectively. The highest proportion (38%) of subjects had duration of diabetes between 10 to 14 years, and another 27% of the subjects had diabetes for More than 15 years. Family history of diabetes was present in 25% of the subjects, and 35% had comorbid hypertension (Table 1).

Assessment of glycemic control showed a major proportion of subjects to be having poor glycemic control. The proportion of subjects with Fasting blood sugar of >200 mg/dl was seen in 79%, and a cumulative percentage of 95% of the subjects had PPBS more than 250 gm/dl. HbA1c assessment showed only 13% with HbA1c value between 6.5 to 7.5%. In the remaining, 23% participants had HbA1c 7.6 to 8.5%, 19 participants had HbA1c 8.6 to 9.5%, 11 participants had HbA1c 9.6 to 10.5% and 34 participants had HbA1c >10.5% (Table 2).

Table 2: Status of glycemic control among the study population (N=100).

	Parameter	Number	%
FBS (Fasting blood sugars)	127-150	6	6%
	151-200	15	15%
	>200	79	79%
2HR PPG (2 hours postprandial blood sugars)	200-250	5	5%
	251-300	40	40%
	>300	55	55%
	6.5 to 7.5	13	13%
HBA1C (glycosylated hemoglobin)	7.6 to 8.5	23	23%
	8.6 to 9.5	19	19%
	9.6 to 10.5	11	11%
	>10.5	34	34%

Out of 100 participants, 82% of participants had diabetic peripheral neuropathy. A total of 6 subjects had cranial neuropathy, with 5% participants having 3rd nerve and one participant had 6th cranial nerve. Involuntary movements (Chorea) was present in 4% of patients. Among the people with Seizures, 6% participants had Hyperglycemic, and 2% participants had Hypoglycemic seizures. Out of 100 participants, only 7 participants had dysautonomia (Table 3).

Table 3: Profile of neurological complications among the diabetic population.

	Parameter	Number	%
Peripheral neuropathy	Patients having diabetic peripheral neuropathy	82	82%
	Patients not having diabetic peripheral neuropathy	18	18%
Cranial neuropathy	3 rd nerve	5	5%
	6 th nerve	1	1%
	Involuntary movements (chorea)	4	4%
Seizures	Hyperglycaemic	6	6%
	Hypoglycaemic	2	2%
Dysautonomia	Present	7	7%
	Absent	93	93%

CVA- cerebrovascular accident namely Ischemic Strokes. Among the 100 subjects, 6% of participants had CVA,

85% participants had retinopathy, and 14% participants had nephropathy (Table 4).

Table 4: Prevalence of other micro and macrovascular complications among study population.

Co-morbidity	Number	Percentage
Patients with CVA	6	6%
Patients with retinopathy	85	85%
Patients with nephropathy	14	14%

DISCUSSION

In the present study, we observed that among all authors participants 35% of them were belonging to 56-65 years age group and majority were males. As observed previously, adults with diabetes mellitus score low in some cognitive tests and subtests than those without diabetes. It is also known that adults with diabetes mellitus score lower on certain cognitive tests and subtests than adults without diabetes.¹⁶ The prevalence of diabetes mellitus was higher in males than females.¹⁷ A study showed majority of females with DM diagnosed and most of participants were of age group between 45-60 years.¹⁸ Most of the participants in this study showed no family history of diabetes. study conducted by Alharithy MK et al, found that parental history of T2DM is significantly associated with diagnosis at a younger age and a higher BMI and waist circumference.¹⁹ Hypertension was presented by lesser number of participants in current study. Previous literature stated that Hypertension as a very common comorbid condition in diabetes, which affects ~20-60% of diabetic population, depending on age, ethnicity and obesity.²⁰

Authors observed that 38% of this study participants were having diabetes since 1014 years. One of the research concluded that only diabetes duration is independently associated with microvascular events having a major effect on young patients.²¹ Majority of authors participants were having FPG test results >200 mg/dl, and 2 Hour Postprandial blood glucose was >300.

Very few of the study subjects presented with Chorea. Diabetic chorea accompanies hyperglycemic states or drastic changes in blood glucose levels and involves the acute onset of unilateral or bilateral choreatic movements.²² This study population showed a predominance of hyperglycemic seizures. DM is an independent risk factor for seizures in elderly individuals.²³ A study revealed a high prevalence of autonomic neuropathy in Type 2 Diabetes mellitus patients.²⁴ Authors found only 7 participants with Dysautonomia.

Present study results majorly focused on the presence of diabetic peripheral neuropathy among 82 study participants. DPN is likely to affect as many as 236 million persons worldwide and at a tremendous cost. In

the United States alone, the total cost associated with DPN is \$10.9 billion a year.²⁵ Jaiswal, M et al, in their study found that the prevalence of DPN was 7% in youth with T1D and 22% in youth with T2D.²⁶ Findings of a comprehensive literature review stated that DPN is often misdiagnosed and inadequately treated. Other than improving glycemic control, there is no licensed pathogenetic treatment for diabetic neuropathy.²⁷ The overall prevalence of DPN was 33.1% in study conducted by Li L Chen.²⁸ In an observational study prevalence of diabetic neuropathy was 60.7% with Significant association between high blood sugar and peripheral neuropathy.²⁹

This study population, 85% of participants, were identified with Diabetic Retinopathy (DR). A cross-sectional study revealed that DR prevalence in its data set was 21.7%.³⁰ A significant association between Duration of DM, male gender and DR was reported.³¹

CONCLUSION

Diabetic peripheral neuropathy was the commonest neurological manifestation presented by this study participants. Authors also observed that cranial nerve palsy, dysautonomia and seizures were other neurological abnormalities. More emphasis should be given on the management of these neurological manifestations related to diabetes as they deteriorate health of patients and cause financial burden.

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REFERENCES

- American Diabetes Association. Diagnosis and classification of diabetes mellitus. *Diabe Care*. 2013 Jan 1;36(1):S67-74.
- Nowotny K, Jung T, Höhn A, Weber D, Grune T. Advanced glycation end products and oxidative stress in type 2 diabetes mellitus. *Biomol*. 2015 Mar 16;5(1):194-222.
- Cho N, Shaw JE, Karuranga S, Huang Y, da Rocha Fernandes JD, Ohlrogge AW, et al. IDF Diabetes Atlas: Global estimates of diabetes prevalence for 2017 and projections for 2045. *Diabe Res Clin Pract*. 2018 Apr 1;138:271-81.
- Anjana RM, Deepa M, Pradeepa R, Mahanta J, Narain K, Das HK, et al. Prevalence of diabetes and prediabetes in 15 states of India: results from the ICMR-INDIAB population-based cross-sectional study. *lancet Diabe Endocrinol*. 2017 Aug 1;5(8):585-96.
- Papatheodorou K, Papanas N, Banach M, Papazoglou D, Edmonds M. Complications of diabetes 2016. *J Diabe Res*. 2016; 6989453.
- Biessels GJ, Kappelle AC, Bravenboer B, Erkelens DW, Gispen WH. Cerebral function in diabetes mellitus. *Diabetologia*. 1994 Jul 1;37(7):643-50.
- Fowler MJ. Microvascular and macrovascular complications of diabetes. *Clin Diabe*. 2008 Apr 1;26(2):77-82.
- Mahmood T, ul Bari A, Agha H. Cutaneous manifestations of diabetes mellitus. *J Pakistan Assoc Dermatol*. 2016 Dec 28;15(3):227-32.
- Cheema S, Maisonneuve P, Zirie M, Jayyousi A, Alrouh H, Abraham A, et al. Risk factors for microvascular complications of diabetes in a high-risk middle east population. *J Diabe Res*. 2018; 8964027.
- Sadikot SM, Nigam A, Das S, Bajaj S, Zargar AH, Prasannakumar KM, et al. The burden of diabetes and impaired glucose tolerance in India using the WHO 1999 criteria: prevalence of diabetes in India study (PODIS). *Diabe Res Clin Pract*. 2004 Dec 1;66(3):301-7.
- Tesfaye S, Selvarajah D. Advances in the epidemiology, pathogenesis and management of diabetic peripheral neuropathy. *Diabe/metabol Res Rev*. 2012 Feb;28:8-14.
- Tesfaye S. Recent advances in the management of diabetic distal symmetrical polyneuropathy. *J Diabe Invest*. 2011 Feb;2(1):33-42.
- Watkins PJ, Thomas PK. Diabetes mellitus and the nervous system. *J Neurol, Neurosurg Psychia*. 1998 Nov 1;65(5):620-32.
- Selvarajah D, Tesfaye S. Central nervous system involvement in diabetes mellitus. *Curr Diab Rep*. 2006;6(6):431-8.
- Corp IB. IBM SPSS statistics for windows, version 22.0. Armonk, NY: IBM Corp. 2013.
- Leibson CL, Rocca WA, Hanson VA, Cha R, Kokmen E, O'brien PC, et al. Risk of dementia among persons with diabetes mellitus: a population-based cohort study. *Am J Epidemiol*. 1997 Feb 15;145(4):301-8.
- Al-Nozha MM, Al-Maatouq MA, Al-Mazrou YY, Al-Harhi SS, Arafah MR, Khalil MZ, et al. Diabetes mellitus in Saudi Arabia. *Saudi Med J*. 2004;25(11):1603-10.
- Jadoon NA, Shah N, Karim R, Zafar A, Ijaz A. Frequency of nonalcoholic fatty liver disease in patients with diabetes mellitus. *Soci Endocrinol BES*. 2017 2017 Oct 20;50: 223.
- Alharithy MK, Alobaylan MM, Alsugair ZO, Alswat KA. Impact of Family History of Diabetes on Diabetes Control and Complications. *Endocr Pract*. 2018;24(9):773-9.
- Arauz-Pacheco C, Parrott MA, Raskin P. Treatment of hypertension in adults with diabetes. *Diabe Care*. 2003;26:S80.

21. Zoungas S, Woodward M, Li Q, Cooper ME, Hamet P, Harrap S, et al. Impact of age, age at diagnosis and duration of diabetes on the risk of macrovascular and microvascular complications and death in type 2 diabetes. *Diabetologia.* 2014 Dec 1;57(12):2465-74.
22. Kenzaka T, Fujikawa M, Matsumoto M. Diabetic chorea as a neurological complication. *Clin Case reports.* 2018 Jul;6(7):1398.
23. Baviera M, Roncaglioni MC, Tettamanti M, Vannini T, Fortino I, Bortolotti A, et al. Diabetes mellitus: a risk factor for seizures in the elderly-a population-based study. *Acta Diabetol.* 2017;54(9):863-70.
24. Magesh A, Johns I, Kannan VP. A study of prevalence of autonomic dysfunction in type-2 diabetes mellitus in a tertiary care center. *JEBMH.* 2018;5(15):1316-20.
25. Gordois A, Scuffham P, Shearer A, Oglesby A, Tobian JA. The health care costs of diabetic peripheral neuropathy in the US. *Diabe Care.* 2003 Jun 1;26(6):1790-5.
26. Jaiswal M, Divers J, Dabelea D, Isom S, Bell RA, Martin CL, Pettitt DJ, et al. Prevalence of and risk factors for diabetic peripheral neuropathy in youth with type 1 and type 2 diabetes: SEARCH for Diabetes in Youth Study. *Diabe Care.* 2017 Sep 1;40(9):1226-32.
27. Iqbal Z, Azmi S, Yadav R, Ferdousi M, Kumar M, Cuthbertson DJ, et al. Diabetic Peripheral Neuropathy: Epidemiology, Diagnosis, and Pharmacotherapy. *Clin Ther.* 2018;40(6):828-49.
28. Li L, Chen J, Wang J, Cai D. Prevalence and risk factors of diabetic peripheral neuropathy in type 2 diabetes mellitus patients with overweight/obese in Guangdong province, China. *Prim Care Diabe.* 2015 Jun 1;9(3):191-5.
29. Alamgir AN. Pharmacognostical Botany: Classification of medicinal and aromatic plants (MAPs), botanical taxonomy, morphology, and anatomy of drug plants. *Therapeutic Use Med Plants Their Extracts.* 2017;1:177-293.
30. Gadkari SS, Maskati QB, Nayak BK. Prevalence of diabetic retinopathy in India: The all India ophthalmological society diabetic retinopathy eye screening study 2014. *Ind J Ophthalmol.* 2016 Jan;64(1):38.
31. Sunita M, Singh AK, Rogye A, Sonawane M, Gaonkar R, Srinivasan R, et al. Prevalence of diabetic retinopathy in urban slums: the Aditya Jyot Diabetic Retinopathy in Urban Mumbai Slums Study-report 2. *Ophthal Epidemiol.* 2017 Sep 3;24(5):303-10.

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