

Awareness and Practices of Foot Care in Patients with Diabetes Mellitus in an Urban Area in Puducherry

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ABSTRACT

Background: Diabetes Mellitus is a potential epidemic with an exponentially growing Prevalence across the globe. In the Region of South East Asia including India there is an established prevalence of 82 million as of 2017 with an expected increase by 84% to an estimated 151 million by 2045. About 10-15% of diabetic patients develop foot ulcers at some point of time during the course of the disease. These ulcers frequently become infected and are the common cause of lower extremity amputation. This study was done to determine the level of knowledge and attitude of patients with diabetes mellitus towards diabetic neuropathy and foot ulcer attending a primary health center.

Aim: This study was taken up in order to assess the Knowledge and Practices of foot care in patients with diabetes mellitus from an urban area in South India in the Union Territory of Puducherry.

Methodology: A cross-sectional study performed by interviewing 60 patients who attended the Diabetic Clinic and Out Patient Departments in a Primary Health Centre in an urban setting in Puducherry. The data thus collected was compiled and analyzed by one-way ANOVA.

Results: In the present study the Mean (SD) of Awareness and Practices of foot care were 4.63 (2.71) and 4.23 (1.93) respectively. Low mean scores were significantly associated with increasing age ($p < 0.05$) and not receiving advice on foot care from doctors. Only 45% of them were educated on diabetic foot care whereas 83.3% of them were advised on physical activity. Only 5% of the subjects had good knowledge, 15% had a satisfactory level and 80% of the subjects had poor or very poor knowledge regarding foot care in patients with

diabetes mellitus. An even lesser proportion of the study population (3.33%) had good practices towards their foot care. 17% had satisfactory practices while 80% of the study population had poor or very poor practices of foot care. A strong positive correlation ($r = 0.79$) was observed between the level of knowledge and practices of foot care which was statistically insignificant ($p = 1.00$).

Conclusion: Low mean scores of knowledge and practices of foot care in patients with diabetes mellitus along with the strong positive correlation between the two, in addition to the exponential rise in incidence and cost for the treatment of both diabetes mellitus and its complications suggest an overwhelming need for early educational intervention on foot care in patients with diabetes mellitus. Limitations: Limitations of this study includes the low sample size.

Key Words: Diabetes Mellitus, Diabetic Foot Care, Peripheral Neuropathy, Micro-vascular Complication of Diabetes Mellitus.

INTRODUCTION AND REVIEW OF LITERATURE

Diabetes Mellitus is a potential epidemic with growing Prevalence across the globe. It is recognized according to the International Diabetic Federation Atlas 2017, that as of 2017 the Prevalence of Diabetes Mellitus in the World is 425 million and an estimated 48% increase is expected to bring this number to 629 million patients by 2045. The Region of South East Asia including India contributes to a large chunk of this population, with an established prevalence of 82 million as of 2017 with an expected increase by 84% to an estimated 151 million by 2045, second

only to the largest fraction contributed by the Western Pacific. [1] The prevalence of diabetes in India, between 1990 and 2016, has risen in India and the increase was noted to be highest in the state of Tamil Nadu. Age-standardized Disability-adjusted life-year (DALY) rate in India for diabetes has increased by 39.6% from 1990 – 2016. This was notably the highest increase among the major non-communicable diseases. [2]

Definitions:

Diabetes Mellitus (DM) is diagnosed if one or more of the following criteria are met: (1) Fasting Plasma Glucose ≥ 7.0 mmol/L (126 mg/dL); (2) Two – hour plasma glucose ≥ 11.1 mmol/L (200 mg/dL) following a 75g oral glucose load; (3) A random glucose > 11.1 mmol/L (200 mg/dL) or HbA1c ≥ 48 mmol/L (equivalent to 6.5%).

Impaired Glucose Tolerance (IGT) is diagnosed if both of the following criteria are met: (1) Fasting Plasma Glucose < 7.0 mmol/L (126 mg/dL) and; (2) Two – hour plasma glucose $\geq 7.8 < 11.1$ mmol/L (≥ 140 to < 200 mg/dL) following a 75g oral glucose load.

Impaired Fasting Glucose (IFG) is diagnosed if both of the following criteria are met: (1) Fasting plasma glucose 6.1 – 6.9 mmol/L (110 to 125 mg/dL) and; (2) Two – hour plasma glucose < 7.8 mmol/L (140 mg/dL) following a 75g oral glucose load. [3]

Regular exercise: At least 30 minutes of brisk walking for 4 days or more in a week.

Regular blood sugar testing: Every quarterly check-up of blood sugar.

Treatment compliance: Daily consumption of medication as advised by the physician. [4]

Types of Diabetes Mellitus:

The types of Diabetes Mellitus include Type 1 (also called Insulin Dependent Diabetes Mellitus or Juvenile Diabetes Mellitus) and Type 2 (also called Adult Onset Diabetes Mellitus). Type 2 is due to insulin resistance developed by the body and Type 1 in most

cases involves an autoimmune destruction of the β cells of islets of pancreas. [5]

Complications of Diabetes Mellitus:

(a) Epidemiology and Pathogenesis of Diabetic Complications:

There is growing evidence that the underlying mechanisms in the pathogenesis of diabetic complications include certain genetic and epigenetic modifications, nutritional factors, and sedentary lifestyle. [6] In animal – zebrafish diabetic models the role of epigenetic mechanisms on the persistence of diabetic complications even after euglycemic control is achieved – a condition known as Metabolic Memory – has been studied. The conclusion of the above study was that DNA – Methylation, in or near genes belonging to DNA replication / DNA metabolism process group, might play a key role in this process. [7]

Ageing, Male gender, Smoking, Low levels of Physical Activity and High Cholesterol have been recognized as independent predictors of Macro-vascular complications. Conversely, Smoking, Hypertension, and Duration of DM over 10 years have proven to be predictive factors for Micro-vascular complications. [8]

(b) Micro-vascular Complications: The mechanisms of micro-vascular complications include; the production of Advanced Glycation End Products (AGEs), the creation of pro-inflammatory microenvironment and the induction of oxidative stress. With regard to the presentation of these complications, Diabetic Neuropathy is the most common complication of Diabetes Mellitus, Diabetic Nephropathy is the leading cause for End-Stage Renal Disease and Diabetic Retinopathy is one of the leading causes for blindness in working-age adults. [9,10]

(c) Macro-vascular Complications: Atherosclerosis is more common in people with Diabetes Mellitus than in the people without Diabetes. A study Describes that DM increases the risk of stroke in people aged 20 to 65 years more than 5 times. [11]

(d) Miscellaneous Complications: Diabetic Cardiomyopathy is a complication that develops independent of coronary artery disease or hypertension and may contribute to morbidity and mortality. [12,13] Epidemiological and basic science evidence suggest possible shared pathophysiology between type 2 DM and Alzheimer's Disease (AD), it has been hypothesized that AD might be "Type 3 Diabetes". [14]

Diabetic Neuropathy and Foot Care in India:

Currently, India is a country with the second-highest number of people with type 2 DM. With this, there is a rise in associated complications as well which has increased individual's health expenditure. [15] A 2018 study estimates 7% adults with diabetes in India, with a higher level in urban (9.8%) than in the rural area (5.7%), a higher proportion of males (7.1%) than females (6.8%). [16] A rural Indian study cited that the prevalence of diabetic foot ulcer among outpatient and inpatient diabetics was found to be 10.4% and around 8.7% of people with diabetes suffered from foot ulcers during 1st year of onset. [17] The diabetic foot ulcers frequently become infected and are the common cause of lower extremity amputation in these patients. [18] Diabetic foot ulcer incidence has been proved to decrease with consistent foot care education. [19] In developing countries like India, where the resources are limited, and treatment costs for diabetes are constantly increasing, the self-care component among patients with diabetes may lead to better economic and therapeutic outcomes. [20]

OBJECTIVES

- To assess the awareness about foot care in patients with Diabetes Mellitus in an urban setting.
- To assess the footcare practices by the aforesaid patients and to educate them on the right way of foot care.

MATERIALS AND METHODOLOGY

Study Area: Urban Area of Villianur, Puducherry, India

Duration spent by each subject for the purpose of this study: 10 minutes

Study Design: Cross-sectional

Study Population: All the diabetic patients both already diagnosed and newly diagnosed patients, attending the Out-Patient Departments, Diabetic Clinics and Camps in Primary Health Center in Villianur, Puducherry, India.

Sample Size: The Sample Size includes 60 subjects in the age group of 30 – 80 years of age of both genders.

SELECTION CRITERIA

Previously diagnosed and newly diagnosed patients with diabetes mellitus in the age group of 30 – 80 years, who are attending the Primary Health Center in Villianur, Puducherry, India.

DATA COLLECTION PROCEDURES

Complete Medical History shall be taken from all the subjects to rule out the exclusion criteria and to identify the presence of Comorbidities.

Informed Consent shall be obtained from all the subjects, with an assurance of Professional Confidentiality with respect to any personal information of the patient obtained which are deemed necessary for the study by the investigator. The right to refuse or terminate at any point of interview shall be assured.

The study subjects shall then be asked to answer a series of questions to assess their awareness and practices with regard to foot care. In a case where the patient is illiterate or is unable to read the Questionnaire due to Literary or Physical disabilities, the investigator shall translate or aid in helping the patient to answer the said questions. The Data from the Questionnaires was collected using Epicollect5 software and statistical analysis was performed using one-way ANOVA.

STATISTICAL ANALYSIS

A total of 60 subjects were interviewed out of which 35 were men and 25 were women with the mean age being 59.17±11.16

ranging from 33 to 80 years. A majority (86.67%) were between 45–75 years of age. In this study 23 subjects presented with other comorbidities; 1.67% presented with Coronary Artery Disease (CAD), 35% of total subjects in the study presented with Systemic Hypertension and 1.67% presented with both Systemic hypertension and CAD.

Physical Activity: In this study, 16.67% of the study population were not practicing regular exercise, all of whom were not advised on the subject prior to the interview. The rest of the study population (83.34%) were practicing regular physical activity, 96% of whom were advised and encouraged by their doctor or health worker, while the remaining 4% gained this knowledge via social media.

Foot Care Awareness and Practices: 45% of the study population were previously advised on diabetic foot care, 96.3% of whom were advised by their doctor and 3.7% of whom gained this knowledge via social media (including TV, Internet). A clear majority, 45 subjects (75%) were lacking satisfactory awareness and foot care practices while only a meagre 9 subjects (15%) were found to have satisfactory awareness and foot care practices. It was also interesting to note that, the bulk of the study population (61.67%) were found to belong to the Upper lower class according to the Modified Kuppusamy socioeconomic scale and were observed to have the least mean scores in awareness (4.3) and practices (3.95) compared to the other socio-economic classes. Additionally, it was noted that subjects aged <55 years had higher mean scores of awareness and practices compared to subjects who were aged >55 years and those with a duration of diabetes < 5 years scored better compared to the rest in both awareness and foot care practices.

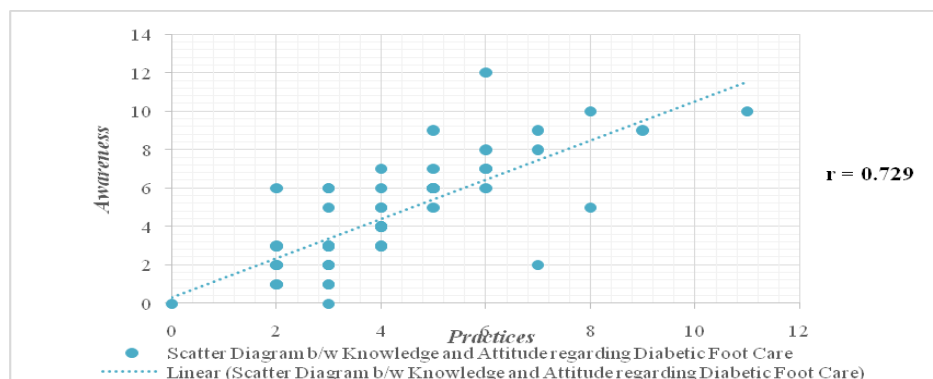
RESULTS

The qualitative and quantitative analysis of the response of 60 subjects to the

questionnaire provided revealed that 15% of the subjects had adequate knowledge and satisfactory foot care practices in order to prevent complications like diabetic foot ulcers. The study more importantly revealed that a vast majority (75%) of the subjects have neither adequate knowledge about foot care nor practice foot care in a manner that will prevent future complications. There was also a small portion of the study subjects (5%) who, despite of having adequate knowledge failed to implement the same in day to day practices due to social/financial difficulties. The Mean (SD) of Knowledge and Practices of foot care were 4.63 (2.71) and 4.23 (1.93) respectively. Low mean scores were significantly associated with increasing age ($p = 0.009$) and not receiving advise on foot care from doctors ($p = 0.0008$). Only 45% of them were educated on diabetic foot care whereas 83.3% of them were advised on physical activity. Only 5% of the subjects had good knowledge, 15% had satisfactory level and 80% of the subjects had poor or very poor knowledge regarding foot care in patients with diabetes mellitus. An even lesser proportion of the study population (3.33%) had good practices towards their foot care. 17% had satisfactory practices while 80% of the study population had poor or very poor practices of foot care. A strong positive correlation ($r = 0.79$) was observed between the level of knowledge and practices of foot care which was statistically insignificant ($p = 1.00$).

Table 1: Socio – demographic profile of the study participants

Particulars	Frequency (n = 60)	Percentage (%)
Age (years)		
< 45	5	8.34
45 – 75	52	86.67
> 75	3	5
Gender		
Male	35	58.34
Female	25	41.67
Religion		
Hindu	57	95
Muslim	2	3.34
Christian	1	1.67
Duration of Diabetes		
< 10 years	35	58.34
10 – 20 years	21	35
> 20 years	4	6.67



Particulars		Frequency (n = 60)	Percentage (%)
Practice of Physical Activity	Yes	50	83.34
	No	10	16.67
Advised Regular Physical Activity	Yes	49	81.67
	No	11	18.34
Advised by whom	Doctor/Health Worker	47	78.34
	Others	2	3.34
Advised Foot Care	Yes	27	45
	No	33	55
Advised by whom	Doctor/Health Worker	26	43.34
	Others	1	1.67

Awareness Score	Practice Score		Total (%)	χ^2 / p
	Not Satisfactory (%)	Satisfactory (%)		
Not Satisfactory (%)	45 (75)	3 (5)	48 (80)	2.9 / 1.00
Satisfactory (%)	3 (5)	9 (15)	12 (20)	
Total (%)	48 (80)	12 (20)	60 (100)	

Characteristics	Frequency (%) (n = 60)	Mean (SD) Awareness	p value	Mean (SD) Practice	p value
Age (years)					
< 55	20 (33.34)	4.61 (2.72)	0.009*	4.22 (1.95)	0.640
≥ 55	40 (66.67)	4.56 (2.67)		4.19 (1.92)	
Gender					
Male	35 (58.34)	4.61 (2.72)	0.555	4.22 (1.95)	0.217
Female	25 (41.67)	4.47 (2.67)		4.18 (1.89)	
Religion					
Hindu	57 (95)	4.63 (2.27)	0.421	4.23 (1.93)	0.701
Muslim	2 (3.34)	4.65 (3.46)		4.47 (2.32)	
Christian	1 (1.67)	2 (-)		3 (-)	
Duration of Diabetes					
< 5 years	16 (26.67)	4.63 (2.74)	0.888	4.23 (1.97)	0.722
5 – 10 years	28 (46.67)	4.50 (2.65)		4.14 (1.89)	
> 10 years	16 (26.67)	4.52 (2.70)		4.17 (1.97)	
Modified Kuppaswamy Scale					
Upper	2 (3.34)	8.5 (4.95)	0.186	5 (1.414)	0.497
Upper Middle	1 (1.67)	8 (-)		6 (-)	
Lower Middle	8 (13.34)	5 (2.98)		4.13 (2.10)	
Upper Lower	37 (61.67)	4.3 (2.22)		3.95 (1.58)	
Lower	10 (16.67)	4.6 (3.63)		5 (3.06)	
Received Advice on foot care					
None	33 (55.00)	4.51 (2.70)	1.11	4.16 (1.94)	0.0008*
Doctor/Health personnel	26 (43.34)	4.63 (2.70)		4.23 (1.93)	
Others	1 (1.67)	8 (-)		6 (-)	

DISCUSSION

The present study includes 60 patients diagnosed with Type II Diabetes Mellitus, majority of whom are males

(58.34%) and the majority of participants were over the age of 55 years (66.67%). A bulk (61.67%) of the participants belonged to the upper-lower class according to the

Modified Kuppusamy Socioeconomic scale. [21] There was a strong positive correlation ($r=0.729$) between the awareness and practices of foot care in diabetic patients. This study showed statistically significant low mean scores of awareness in diabetic patients with increasing age ($p=0.009$) and low mean scores of practice of foot care in diabetics who received no advice on foot care prior to the study ($p=0.0008$).

Similar results were observed in a study done by Deepa L.N et al in Karnataka, India which found a strong positive correlation ($r =0.87$, $p<0.001$) between the level of knowledge and the practices of foot care in diabetics. It concluded that the awareness and foot care practices among known diabetic patients attending their hospital were not at a satisfactory level and that the treating doctor should routinely educate diabetic patients on foot care measures. [22]

A similar study in Saudi Arabia done by Qadi M A et al in the year 2011 showed that the practice scores were significantly lower in educational level. [23] However, a more recent study by Alhuqayl A A et al (2019) showed the prevalence of high knowledge on foot care in diabetic patients have improved since then to about 53.3%, which was concluded to be promising and better compared to previous studies in Saudi Arabia. [24]

A 2015 study done in a rural area in Kancheepuram, Tamil Nadu by Shrivastava PS et al observed that while the majority of the subjects (82.5%) agreed to be regularly wearing footwear, only 17.5% of them took extra care about their feet. Said study also came to the conclusion that while the majority of the subjects had correct and adequate knowledge, they were significantly lacking in terms of self-care practices. [4]

A cross-sectional study in Taiwan in 2012 by Chin Y et al via a logistic regression model revealed that select action cues (recommendations from family, friends or health professionals) played a significant role in the patients' foot care practices. [25] A 1-year interventional study done by Kotru S

et al, 2015 in Punjab, India observed that intensive education, training, and customized footwear reduced the risk of developing new ulcers / diabetic foot by 13%. [26] An open-label randomized control study conducted in AIIMS New Delhi by Rahaman HS et al observed that there was a statistically significant improvement in knowledge and foot care practices in diabetic patients as early as 3 months after an intervention using a patient module with audio-visual display and a pamphlet on diabetes foot care. [27]

The results of the present study in Puducherry, India match the ones mentioned above and stress the importance of advice regarding diabetic foot care to patients at the time of diagnosis/during subsequent follow-ups.

CONCLUSION

This study quantitatively and qualitatively assesses the awareness and practice among the urban diabetic population about foot care and prevention of extreme complications of diabetic neuropathy leading to amputation. The dearth of resources in developing countries like India, the increasing trend of cost of treatment of diabetes and its complications with the exponential rise in the incidence of diabetes make prevention of the aforesaid complications even more vital than managing the same. Thus, with increasing awareness and good practices of diabetic foot care, morbidity, mortality and financial strain over the patient can be largely reduced and the patient's quality of life along with DALY rates can be improved with minimal expenditure. This can also be achieved by means of audio-visual, educational pamphlets or one to one patient education by the health personnel at the time of diagnosis or during follow-up visits. Further interventional studies in this regard will prove useful to evaluate and improve foot care practices in diabetics.

Limitations: The authors feel that the study was done for a small sample size and further studies

in the future may be done with a larger sample size in order to avoid errors in data analysis.

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