

INCIDENCE OF DIABETIC NEUROPATHIC FOOT SYNDROME AT THE UNIVERSITY COLLEGE HOSPITAL IBADAN: INDICATION FOR ROUTINE PHYSIOTHERAPY

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ABSTRACT

This study evaluated the foot of lower limb diabetic neuropathic patients to ascertain the possible roles of Physiotherapy in the total management of diabetic foot. Fifty diabetic patients of the University College Hospital, Ibadan, Nigeria who have lower limb diabetic neuropathy participated in this study. Thirty nine were Type-II and eleven were Type-I diabetics, aged between 34 and 91 years. They were tested for disturbance of motor, and sensory functions as well as dermatological state to know the severity of the neuropathic foot.

Results showed no significant difference between the response of the Type-I and Type-II diabetics to temperature, pressure and motor tests and there was no significant difference in their dermatological state ($P < 0.05$). Low and negative correlation was seen between the duration of onset of neuropathy and the degree of temperature, pressure, motor response and dermatological state of the patients.

It was concluded that diabetic patients in this study had impaired dermatological state and sensory-motor response. The impairment can result in complications such as blister, cracks and anaesthetic foot. The study recommended that physiotherapy modalities such as hydrotherapy, wax therapy and exercise therapy be used to prevent and treat complications of diabetic neuropathic foot, hence diabetic patients should be referred routinely for physiotherapy to prevent and treat the complications of diabetic neuropathic foot syndrome.

KEYWORDS: *Diabetic Neuropathy, Physiotherapy*

INTRODUCTION

Diabetes mellitus is a heterogenous group of disorders characterized by a high blood glucose level, relative or absolute insulin deficiency and numerous metabolic and hormonal derangements affecting carbohydrate, protein and fat metabolism. The World Health Organization (WHO) technical committee report¹ classified diabetes mellitus into two main clinical categories namely: Type - I otherwise called Insulin Dependent Diabetes Mellitus (IDDM) and Type -II also known as Non-Insulin Dependent Diabetes Mellitus (NIDDM).

Neuropathy is a term used to describe the affectation of any segment of the nervous system. The peripheral neuropathy seen in diabetes mellitus could be motor or sensory. In peripheral neuropathy affecting the motor nerves, there is decreased nerve conduction velocity leading to decreased impulses to the muscles. This results in decreased muscle contractions, onset of muscle contractions, onset of muscle weakness, muscle wasting, contractures and loss of joint mobility especially of the small joints of the hands. Associated with the diabetic neuropathy are collagen abnormalities which are probably caused by increased non-enzymatic protein glycosylation².

A significantly increased frequency of clinically symptomatic neuropathy in subjects with limited joint mobility of the hand has been reported³. This is in line with the earlier observation that flexion contractures in the diabetic hand were associated with

peripheral neuropathy³. The foot of the diabetic patient is susceptible to diabetic complications of vascular disease and neuropathy. The pathological changes may result in compromised motor, autonomic and sensory functions and response of the affected foot. The foot with impaired sensation due to the diabetic complication of neuropathy can be readily injured leading to skin abrasion, wound and ulcer with attendant complications of infection, gangrene, deformities and possible loss of function.

The Physiotherapist is concerned with the management of variety of complications resulting from diabetes mellitus. Some of the diabetic complications for which physiotherapy is indicated include neuropathy, angiopathy musculoskeletal derangements, diabetic ulcers and amputations. The purpose of this study was to evaluate the incidence of the diabetic neuropathic foot with the aim of identifying what physiotherapy can offer in managing this presentation and thus establish the indication for routine referral of diabetic patients to physiotherapy for the prevention and physical treatment of diabetic neuropathic foot syndrome among diabetic patients receiving treatment at the diabetic clinic of the UCH Ibadan.

MATERIALS AND PROCEDURE

SUBJECTS:

Fifty male and female adult diabetic patients who had been diagnosed as having lower limb diabetic neuropathy and who were attending the Medical Out-patient Diabetic Clinic of the University College Hospital, (UCH) Ibadan, Nigeria, participated

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in this study. They were recruited into the study as they became available. The subjects were tested for disturbance of motor, sensory functions and the dermatological state of the foot to know the degree of severity of the neuropathic foot. Informed consent was sought and obtained from the diabetic subjects.

MATERIALS

The instruments used in the study were:

1. Semmes Weistein monofilament which was used to test for pressure sensation on the pressure points at the sole of the foot.
2. Two test tubes with warm and cold water respectively were used to test for skin sensitivity to temperature.

PROCEDURE

The following information on the subjects were recorded at the commencement of the study: age of the patient, sex, type of diabetes (Type-I or Type-II), the duration of diabetes, duration of onset of neuropathy and site of amputation (where applicable).

Motor function test of the foot was carried out by assessing the strength of ankle flexor and extensor muscles and graded using the Oxford muscle grading scale. This scale grades muscle strength from 0 to 5.

Grade 0 is total paralysis

Grade 1 is flicker of muscle contraction

Grade 2 is movement in gravity free plane

Grade 3 is movement against gravity

Grade 4 is movement against gravity and additional resistance

Grade 5 is normal muscle strength.

To test for some dermatological state of the foot, the patients laid supine on a firm plinth. The sole of the foot was graded as follows:

Grade 1 is deep cracks and ulcer

Grade 2 is deep cracks only

Grade 3 is superficial cracks

Grade 4 is heavy callus around the pressure points. Grade 5 is smooth skin⁴.

Sensory functions were carried out for temperature and pressure sensations. To test for temperature sensation, water at temperature of 40°C and 44°C was put in two separate test tubes. The sides of the 2 test tubes were used to touch the feet of patient one after the other for a period of 3 - 5 seconds and the patient indicated whether warm or cold sensation was felt. The

response to this test was graded as follows:

Grade 1 is loss of sensation to both warm and cold

Grade 2 is ability to identify the touch with no temperature differentiation

Grade 3 is ability to feel cold only

Grade 4 is ability to feel warm only

Grade 5 is ability to feel both cold and warm⁵.

Pressure sensation was tested by exposing the sole of the foot with the subjects lying supine and blindfolded. Semmes - Weistein monofilaments 2.83, 3.61, 4.17, 5.07 and 6.10 markings were applied in ascending order perpendicular to the skin with 1 - second touch, 1 - second hold and 1 - second lift. During the period of touch, force was applied slightly so that the filament clicked thus exerting required force. The force applied by the monofilament is a function of the instrument rather than that of the examiner. The patient responded saying "yes" when a touch was perceived and grading was done as follows:

	Filament Marking	Pressure grades gm/mm ²
Grade 1 Untestable	>6.65	>43.9
Grade 2 Loss of protective sensation	4.56 - 6.65	42.3 - 43.9
Grade 3 Diminished protective sensation	3.84 - 4.31	19.3 - 33.1
Grade 4 Diminished Light touch	3.22 - 3.61	11.1 - 17.1
Grade 5 Normal	1.65 - 2.83	1.45 - 4.85

DATA ANALYSIS

Descriptive statistics of mean and standard deviation were computed for the motor, dermatological state and sensory function (Pressure and temperature) grades for the male and female diabetic subjects. The independent t-test was used to compare the mean values obtained for Type-I and Type-II as well as for male and female diabetics. Pearson product moment correlation was used to find the relationship between duration of onset of diabetic neuropathy and the extent to which motor, dermatological state and sensory functions were compromised. Level of significance was set at 0.05 alpha.

RESULTS

Fifty adult diabetic patients diagnosed as having lower limb neuropathy participated in this study. None of these patients was receiving physiotherapy either as part of the total

Table 1: Physical Characteristics of the Diabetic Subjects

	Male (n = 32)	Female (n = 18)	IDDM (n = 11)	NIDDM (n = 39)	t-Value TYPE-I vs TYPE-II	p level
Age (X±S.D)	57.47±12.90	52.72±10.56	53.45±18.17	56.41±11.936	0.642	>0.05
Onset of Diabetes neuropathy (X±S.D)	603±2.89	6.39±2.97	5.909±3.56	6.23±2.729	0.322	>0.005

Table 2: Comparison of Mean Dermatology State and Sensory Motor Ratings of Diabetic Subjects.

	Male (n = 32) X + S.D	Female (n = 18) X + S.D	I-value Male vs Female	TypeI (n = 11) X + S.D	TypeII (n ~ 39) X + S.D	t-value type I vs Type II
Dermatology State	3.2±1.37	3.22±1.56	0.07	3.45±1.44	3.38±1.29	0.155
Temperature	2.63±1.39	2.50±1.51	0.30	3.09±1.58	2.41±1.37	1.407
Pressure	3.26±1.11	3.69±1.14	1.17	3.45±1.29	3.48±1.09	0.840
Motor	4.0±0.96	3.88±0.75	0.50	4.0±0.89	4.05±0.72	0.197

Table 3: Relationship Between Dermatological State, Sensory Motor Ratings and Duration of Onset of Neuropathy.

	Dermatology State	Temperature	Pressure	Motor
Duration of Onset of Neuropathy	-0.1 19	-0.347	-0.059	-0.062

management of diabetic mellitus or for the clinical features of neuropathic foot. The subjects comprised of 32 males and 18 females. 39 were Type-II while 11 were Type-I diabetic patients. The mean age of all the subjects was 55.76 ± 12.13 years. The mean age of the male diabetics was 57.42 ± 12.90 years while the mean age for the female diabetics was 52.72 ± 10.56 years. The mean age of the Type-II and Type-I were 56.41 ± 11.94 and 53.45 ± 18.17 years respectively. The mean duration of onset of diabetic neuropathy in the 50 patients was 6.16 ± 2.90 years while the mean duration of onset was 6.03 ± 2.89 and 6.39 ± 2.97 years for and female patients respectively. The Type-II and Type-I patients had mean duration of onset 6.23 ± 3.73 and 5.91 ± 3.56 respectively (Table 1).

The t-test showed no significant difference in the response of male and female subjects to autonomic, temperature, pressure and motor tests ($P > 0.05$) as shown in table 2. No significant difference was seen between dermatological state temperature, pressure and motor responses, of the Type-I and Type-II patients (Table 2).

The outcome of Pearson's product correlation indicated a low and negative correlation between the duration of onset of neuropathy dermatological state, temperature, pressure and motor responses in the diabetic patients (Table 3).

DISCUSSION

The volunteer diabetic patients who participated in this study comprised of 32 males and 18 females. The mean age of the patients with diabetic neuropathy foot was 55.76 years which corroborate with submission of a previous study that diabetic neuropathy is common among diabetics in their fifth decade of life⁶. The relatively higher number of males than females observed

in this study is in agreement with the findings of a past study that diabetic neuropathic foot is more prevalent among male patients than females⁷.

Whereas it was opined that the type of diabetes mellitus had no bearing with the incidence of neuropathic foot⁶, this study however showed that more patients with TypeII diabetes had neuropathic foot than the Type-I patients. This may be due to the preponderance of Type II diabetes in this environment and elsewhere^{8,9}. There was no significant difference in the duration of onset of diabetes neuropathy in the male and female patients and in type-I and Type-II patients. Onset of neuropathy in diabetes is believed to be a direct function of glycaemic control in the blood rather than factor of gender or type of diabetes.

However, the low and negative correlation between the duration of onset of diabetic neuropathy and the sensory motor responses of the patients in this study imply an inverse but weak relationship. The longer the duration of diabetes neuropathy, the less the response of the diabetic patients to pressure, motor, dermatological state and sensory stimuli. The clinical features of diabetes neuropathic foot include cracks, blisters, ulcers, numbness, function and sensory-motor response. Exercise therapy (passive, active and resisted) can be used as a modality to enhance glucose uptake and utilization¹⁰, improve circulation to the limb, prevent muscle weakness and wasting, increase range of joint movement, prevent contractures and deformities and promote functions. Hydro and wax therapies can be used to enhance and promote suppleness of the skin, improve circulation and break down adhesions in collagen abnormalities. Appropriate foot wear design can prevent blisters, cracks, trauma, ulceration, infection, gangrene and amputation in the insensitive diabetic neuropathic foot.

The above listed physiotherapy modalities have no known adverse effect on the pathology and medical treatment of diabetes mellitus. Rather, studies have confirmed the beneficial effects of therapeutic exercises in the total management of diabetes mellitus¹⁰. It is cheaper, more effective and more rewarding to prevent gangrene and subsequent amputation than to rehabilitate a diabetic amputee.

CONCLUSION

It is concluded from this study that the onset of diabetic neuropathy adversely affects dermatological state and sensory-motor response in diabetic foot syndrome. It is also concluded that there is a higher prevalence of diabetes neuropathic foot in Type-II compared to Type-I subjects and in the male compared to female subjects. The large number of patients with neuropathic foot during the period of this study indicates the need to recommend routine physiotherapy as part of the total management of diabetes mellitus.

RECOMMENDATION

The clinical applications of results of this study is based on the clinical features of the neuropathic foot and the incidence. These justify the recommendation of routine physiotherapy for the prevention, delay in onset and treatment (as the case may be) for diabetes neuropathy with the use of physical therapy as one of the treatment modalities.

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