EXTENT OF NEUROPATHY IN DIABETIC FEET

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ABSTRACT
Objectives: *To determine the extent of neurological deficit in patients with diabetic foot according to Neuropathy disability score and Nerve conduction studies.*
Study Design: *Case series.*
Setting & Duration: *Department of Surgery Unit III Civil Hospital, Karachi from January 2004 to December 2005.*
Methodology: *This study of two years duration 2004 and 2005 includes 30 who were admitted in Surgical Unit III of Civil Hospital, Karachi for the treatment of Diabetic Foot. The inclusion criterion was patients between 35 to 60 years of age of with diabetic foot complications.*
Results: *Clinically neuropathy was detected in all the patients; the disability scoring showed mild involvement in 3(10%) patients, moderate in 8(26.66%) and severe in 19(63.33%) patients. Nerve conduction studies performed in these patients showed severe involvement of the sural (sensory) nerve in all the cases. The peroneal and tibial (motor) nerves were also involved in all the cases but with a variable extent.*
Conclusion: *This study showed that neuropathy is strong independent risk factors in the development of diabetic foot lesions. It is important to identify and quantify the role of neuropathy in order to plan effective strategies for preventing and delaying the foot complications.*

KEY WORDS: *Diabetic Foot, Neuropathy*

INTRODUCTION

Diabetes mellitus with its associated complications is a major cause of morbidity and mortality, especially the foot problems. Diabetic foot is one of the most frequent reasons for hospitalization in a surgical ward; its complications include abscess formation, cellulitis, ulceration and gangrene.[1] The risk of lower extremity amputation is 15 to 40 times higher in a diabetic patient than in the non-diabetics.[2]

Peripheral neuropathy is very commonly seen in diabetic cases, resulting in distal bilateral sensory changes like paraesthesia, pain in feet and neuropathic ulcers. It leads to alteration in the skin of limbs, which becomes hard and discoloured with even resorption of tissues. Screening and early identification of the neuropathic process can alter the course of the disease.[3]

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There is deterioration of segmental nerve myelination and axonal structure that is reflected in decreased nerve conduction velocity and depressed nerve amplitude respectively.[4] "A" fibers, which convey sensation of force, are affected more than "C" fibers which convey the sensation of pain.[5] Neuropathy is assessed clinically by the Neuropathy Disability Score (NDS) and Nerve Conduction Studies (NCS). NDS is based on examination of the tendon reflexes and sensory modalities like pin prick using a pointed metal or wooden pin, light touch using a strip of cotton ball, vibration using a tuning fork, temperature using a test tube filled with cold or hot water. By NCS we can usually differentiate between a primary demyelinating and a primary axonal lesion. In case of polyneuropathies this is of considerable diagnostic and prognostic importance. NCS also help in the localization of the lesion (nerve, neuromuscular junction, muscle), its severity and temporal course (acute, hyper-acute, subacute, chronic).[6]

The accurate diagnosis of the underlying cause is the first step towards a successful treatment plan. Preventive foot care consists of identification of risk factors in the feet of diabetic patients. Implementation of measures for preventive foot care includes patient education, regular chiropody, use of special footwear and frequent

reviews; and will go a long way in substantially reducing the development of complications in the diabetic feet.

METHODOLOGY

This prospective descriptive study of two years duration from January 2004 to December 2005 includes 30 cases on non-probability purposive bases who were admitted in Surgical Unit III of Civil Hospital, Karachi for the treatment of Diabetic Foot. The inclusion criteria was patients between 35 to 60 years of age of both sexes with diabetic foot complications and patients excluded from study were patients having renal and cardiac complications, on immuno suppressive drug therapy and patients with other metabolic and hormonal disorders.

Informed consent was obtained in all cases. Detailed history and clinical examination Neuropathy disability score was assessed on the bed side by checking sensations with cotton wool, pin prick, temperature by cold and hot water containing test tubes, position sense and vibration sense by 128 Hz tunning fork; and knee and ankle reflexes elicited on all patients. Complete routine laboratory investigations done. Neurostar Medelec-92B was used to do the nerve conduction studies. Motor and sensory nerve conduction velocities were recorded in the tibial nerve, peroneal nerve and sural nerve respectively. The skin temperature was maintained between 35-36oC in an air-conditioned room.

Data was analyzed by SPSS versoin-10 for descriptive and analysis.

RESULTS

Thirty diabetic patients with foot complications including abscess, cellulitis, ulcer and gangrene was assessed for the extent neuropathy in these diabetic foot patients.

Out of the total 30 patients, 22(73.33%) were males and 8(26.67%) females. The age incidence and other epidemiological findings are given in Table I. The data of symptomatology revealed that 9(30%) patients had mild while 21(70%) had severe pain. Twelve (40%) patients reported mild numbness and fatigability, and 17(56.66%) severe. Thirteen (43.33%) patients complained of mild weakness and 16(53.33%) severe weakness.

Nerve conduction studies performed in these patients revealed 100% involvement of sensory (sural) nerve and motor (peroneal and tibial) nerves. Data of tibial nerve conduction study showed mild neuropathy in 3(10%) patients, moderate in 9(30%) and severe in 19(63.33%) patients, whereas involvement of peroneal nerve was observed as mild in 6(20%) patients, moderate in 6(20%) and severe in 18(60%) patients. The involvement of the sural nerve was seen as severe in all the patients.

The summary of the neuropathy results is depicted in Table II.

DISCUSSION

Foot complications in patients with diabetes can be prevented and managed with an integrated, multidisciplinary approach. It requires the involvement of a chain extending from the chiropodist and general practioner to the general surgeon, vascular surgeon and the rehabilitation specialists. The diabetic foot patients have a high morbidity and mortality rate due to multiple operations and prolonged hospital stays,[7] hence accurate diagnosis of the underlying cause is the first step towards a successful treatment plan. The most important intervention to prevent diabetic foot complications is early recognition of high risk patients and their referral to the multidisciplinary team.[8] Prompt treatment decreases the risk of the fatal outcome i.e. amputation.

The incidence of foot complications is more in Type-II diabetics.[9] Persistent hyperglycaemia is a major etiological factor in the development of neuropathy in these diabetics. In this study, out of the total 30 patients,

Table I. Site of lesion

Feature	No.	Percentage
Gender		
Male	**22**	**73.33**
Female	**8**	**26.67**
Age Group		
35-40 Years	**1**	**3.33**
41-45 Years	**5**	**16.67**
46-50 Years	**7**	**23.33**
51-55 Years	**2**	**6.67**
56-60 Years	**15**	**50.00**
Diabetes		
Type I	**10**	**33.33**
Type II	**20**	**66.67**
Smoking		
Smokers	**13**	**43.29**
Non-Smokers	**17**	**56.61**

Grading	Peroneal Nerve	Tibial Nerve	Sural Nerve	Neuropathy Disability Score
Mild	9.99%	19.99%	0.00%	0.00%
Moderate	26.66%	19.99%	0.00%	0.00%
Severe	63.33%	59.99%	99.99%	99.99%

Table II. Results of neuropathy in diabetic foot lesions

33% belonged to Type-I and 67% to Type-II diabetes mellitus. This showed increased prevalence amongst Type-II diabetics. This finding has been reported in other studies also.[10]

Ageing is associated with neuropathic ulcers in individual with diabetes.[11] Few studies have been published on prevention of foot lesions and even neuropathy in individuals with diabetes.[12] Majority (56.67%) of our patients with diabetic foot were above 50 years of age. The duration of diabetes was more than 12 years in most of the patients. This shows that there is an increase in the incidence of the diabetic foot as the duration of diabetes increases. This proves the link between the duration of the disease and development of diabetic complications109. We know that the over all incidences of Type-II diabetes is high amongst the elderly. The risk of developing leg ulcers is definitely increased amongst people who had diabetes for more than 10 years.[13]

In this study the clinical Neuropathy Disability Scoring revealed mild involvement in 3(10%) patients, moderate in 8(26.67%) and severe in 19(63.33%) patients. Nerve conduction studies also showed 100% involvement of the sensory (sural) and motor (peroneal and tibial) nerves. The sural nerve was severely affected in all the cases. The data of motor nerves conduction study revealed that the tibial nerve was mildly involved in 3(10%) patients, moderately in 9(30%) and severely in 19(63.33%) patients, whereas the involvement of the peroneal nerve was observed as mild and moderate in 6(20%) patients each and severe in 18(60%) patients. This significant reduction of motor nerve conduction velocity of deep peroneal nerve and tibial nerves, and sensory nerve conduction velocity of the sural nerve was also demonstrated by other authors like Veves[14] and Ficicaglu.[15]

These findings rests on the metabolic basis of the pathogenesis of diabetic neuropathy i.e. persistent hyperglycemia in these patients.[16] It is universally accepted that peripheral neuropathy is an important pathophysiological risk factor for the development of foot ulcers.[17] No electrodiagnostic results are specific for diabetic polyneuropathy. However, electrodiagnostic evidence of axonal degeneration and substantial conduc-tion slowing in the proper clinical setting is suggestive of diabetic polyneuropathy. A reduced conduction velocity has a high sensitivity but a low specificity in detecting diabetic polyneuropathy.[18] A reduce SNAP amplitude (especially the sural) has a high specificity and sensitivity in detecting any sensorimotor polyneuro-pathy.[19] In summary, this study shows that neuropathy is strong risk factor in diabetic foot lesions.

CONCLUSION

This study showed that neuropathy is strong independent risk factors in the development of diabetic foot lesions. It is important to identify and quantify the role of neuropathy in order to plan effective strategies for preventing and delaying the foot complications.

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