

## Multi-disciplinary rehabilitation for management of diabetes mellitus related neurological and musculoskeletal complications

Sami Ullah,<sup>1</sup> Dilshad Hunain Al Arabia,<sup>2</sup> Farooq Azam Rathore<sup>3</sup>

### Abstract

Diabetes Mellitus (DM) is one of the most common metabolic disorders in the world. It can result in several neurological and musculoskeletal (MSK) conditions. These conditions adversely affect the mobility, community functioning and quality of life for the patient with DM. Rehabilitation Medicine Physicians (Physiatrists) can offer both diagnostic and therapeutic interventions for the accurate diagnosis and optimal management of neurological and MSK conditions associated with DM. These include diagnostic tests such as Nerve Conduction Studies and Electromyography, therapeutic interventions in form of pharmacological management of symptoms, prescription of appropriate physical therapy, occupational therapeutic exercise, injections, as well as psychosocial and cognitive interventions. A physiatrist can provide expert advice on musculoskeletal disorders in patients with DM, as they are formally trained in the evaluation, diagnosis, and management of MSK conditions. A multidisciplinary team for DM should include a physiatrist as one of the key members. This can help effectively address neurological and MSK disorders related to DM.

**Keywords:** Rehabilitation Medicine, Physiatry, Physiotherapy, Occupational therapy, Pain management, Assessment, Diabetes Mellitus, Quality of Life.

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### Introduction

Diabetes Mellitus (DM) is on the rise globally and considered an important cause of disability and death worldwide.<sup>1</sup> In 2015, it was reported that the Eastern Mediterranean region had a 216% increase in death rate due to diabetes mellitus compared with 1990.<sup>2</sup>

DM can result in several neurological and musculoskeletal (MSK) conditions. These conditions adversely affect the mobility, community functioning and quality of life for the

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<sup>1</sup>Department of PM&R, Qatar Rehabilitation Institute, Hamad Medical Corporation, Doha, Qatar, <sup>2</sup>Dow University of Health Sciences, Baba-e-Urdu Road, Karachi, <sup>3</sup>Armed Forces Institute of Rehabilitation Medicine (AFIRM), Rawalpindi, Pakistan.

**Correspondence:** Farooq Azam Rathore. Email: farooqrathore@gmail.com

patient with DM. Common MSK disorders in patients with diabetes include carpal tunnel syndrome, limited joint mobility, adhesive capsulitis, Dupuytren's contracture, diabetic muscle infarction, and diffuse idiopathic skeletal hyperostosis. In a developing country like Pakistan where the focus is usually on the medical management of the disease, such issues do not receive much attention. We aim to highlight the important role of multidisciplinary rehabilitation in the comprehensive management of neurological and MSK conditions associated with DM.

### MSK Conditions

A 2013 study from Pakistan documented MSK disorders in patients with DM.<sup>3</sup> Fifty four percent had at least one musculoskeletal abnormality and 30% had upper limb musculoskeletal manifestations on examination. The common complications reported in this group were limited joint mobility (9.5%), carpal tunnel syndrome (9%), trigger finger (3.8%), Dupuytren's contracture (1%), adhesive capsulitis (11.5%) and tendonitis (9%).<sup>3</sup>

### Diabetic Polyneuropathy

Neurological complication such as diabetic peripheral neuropathy (DPN) is another common consequence of the disease. The prevalence of DPN varies depending on factors including type of diabetes, duration of diabetes and type of neuropathy. The prevalence of painless DPN is 26 - 50%<sup>4</sup> while painful DPN has been reported in 8 - 30 % of patients with diabetes.<sup>5</sup> DPN results in sensory and motor nerves dysfunction, particularly affecting the lower limb muscle strength, gait instability, balance and hence increases the risk of falls due to low safety perception.<sup>6</sup>

### Neuropathic Ulcers

Neuropathic ulceration is another disabling condition, reported in up to 15% of patients with DM. If not managed appropriately it can result in dysvascular amputation.<sup>7</sup> The possible etiological factors include loss of sensation due to neuropathy, arterial disease and unequal pressure distribution over plantar surface of the foot with sensory impairments resulting in an increased risk of ulceration. Gait abnormalities, poor posture and balancing are contributing biomechanical factors, which also need to be addressed. There is evidence that a structured exercise and physical

activity programme can play a role, reducing the risk of developing a diabetic foot.<sup>8</sup>

### **Sarcopenia**

Sarcopenia is a common finding in the aging population characterized by generalized loss of skeletal muscle mass. It is considered to adversely affect quality of life of elderly individuals especially who already suffering from another co-morbid like diabetes mellitus. Various underlying factors play a role in the development of sarcopenia. Type 2 diabetes mellitus results from impaired insulin sensitivity, which also affects skeletal muscle since, the anabolic action of insulin is no longer present resulting in the degradation of muscle protein. Chronic diabetes results in accumulation of glycosylation end products, inflammatory cytokines causing loss of muscle mass, and reduced strength. Muscle ischaemia secondary to peripheral arterial disease (a common complication in DM), is also a contributing factor in developing sarcopenia, impairing strength and muscle mass. Since muscle mass and strength directly affects muscle function therefore sarcopenia is associated with adverse health outcomes like increased risk of falls, fracture, reduced mobility, depression, cognitive impairment, functional decline, and mortality. Improving physical activity and doing exercise helps build muscle strength and posture control which can prevent various complications associated with sarcopenia.

### **Recurrent Falls**

Patients with DM aged 65 years and above have a 67% increased risk of recurrent falls.<sup>9</sup> Physical function is impaired because it reduces the patients' confidence due to fear of falling during standing and walking activities,<sup>10</sup> consequently causing loss of muscle and bone strength. In these cases, loss of muscle and bone strength can be improved by supervised exercise regimes for specific muscle groups along with weight bearing exercises. Therefore, to prevent secondary complications of DPN, and to achieve these therapeutic goals, a rehabilitation team will play an important role.

### **Role of the Rehabilitation Team in Optimal Management of Diabetes Mellitus**

A rehabilitation team is multi-disciplinary in which different rehabilitation professionals with a diverse set of skills and training collaborate to formulate a custom-made plan for the person with an impairment or disability. Rehabilitation Medicine Physicians (physiatrists) are trained in the assessment, clinical evaluation and formulating an individually tailored exercise programme. This intervention, if implemented early, has the potential to reduce the risk of developing a

diabetic foot ulcer. The Physical Therapist can help with strengthening exercises of the key muscles in the upper and lower limbs, balance training as well as working on strategies to reduce the risk of falls. They also help with prescription of gait aids. The Orthotist can design and fabricate special footwear to help the diabetic patient with poor balance due to sensory dysfunction and reduce the occurrence of diabetic foot. Physiatrists offer diagnostic as well as therapeutic interventions such as Nerve Conduction Studies and Electromyography, injections, and pharmacologic symptom management, along with physical, occupational therapeutic exercise, and psychosocial and cognitive interventions. A physiatrist can offer expert advice on musculoskeletal disorders in patients with DM, as they are formally trained in the evaluation, diagnosis and management of MSK conditions.

Their expertise in pain management and diagnostic blocks can help alleviate the pain and suffering of these patients. For example, adhesive capsulitis of the shoulder is a painful musculoskeletal complication, particularly in the initial stages of the disease. The prevalence of this chronic painful musculoskeletal disorder ranges from 10-22% in patients with underlying diabetes mellitus.<sup>11</sup> A rehabilitation physician can provide a range of conservative treatment options, including prescription of pain-relieving medicines, muscle relaxants, therapeutic exercise, injections intra-articular steroids and other regenerative agents which provide early pain relief and improve health related quality of life.<sup>12</sup> The risk of falls in these patients can be reduced by muscle strengthening exercises, gait training, proprioceptive training via virtual reality and sensory re-education, along with the prescription of suitable footwear or orthosis where necessary, to prevent neuropathic complications.<sup>13</sup>

These goals can be successfully achieved by a physiatrist lead multidisciplinary diabetes care team, with expertise in prescribing specific exercise and rehabilitation care plans as per medical condition and symptomatology. The formal role of rehabilitation professionals in a healthcare team for the management of DM is a relatively new concept even in the developed countries, as evident from the scientific literature.<sup>14</sup>

In Southeast Asia, an example of this multidisciplinary rehabilitation team exists at Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine, and Metabolic Disorders (BIRDEM), Dhaka, Bangladesh. BIRDEM is a 600 bed hospital located in Dhaka, which was established by the Diabetic Association of Bangladesh in 1980. There is an independent PMR department actively involved in providing outpatient and inpatient services.

The Physiatrist manages diabetes-related MSK and neurological conditions. An Honorary Consultant is working as the Head of the department along with an Associate Professor, one junior consultant and medical officers.<sup>15</sup>

## Conclusions

DM is a common metabolic disorder globally and the number is expected to rise. The DM related MSK and neurological complications are disabling and can result in chronic pain, compromised mobility, and a poor quality of life. A multidisciplinary rehabilitation team including a physiatrist (Rehabilitation Medicine specialist) as one of the key members can help address these issues effectively.

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