



## Physical Therapy in Diabetic Complications

Diabetes Mellitus is now a global epidemic. Usually co-related with being overweight and obese, a sedentary lifestyle and familial history are also being considered as risk factors. The prevalence of diabetes is higher in men than women. Diabetes can be categorized as acquired or hereditary. The lack or decrease in exercise, elevated stress levels, and unhealthy diet all predispose an individual to Type 2 Diabetes Mellitus even without a clear family history. Considered an endocrine disorder, this could also occur in pregnant women during gestational stage. Over time, it results in serious small and large vessel vascular complications and neuropathies.

Classic triad of Diabetes Mellitus are polydipsia (increased thirst), polyphagia (increased appetite and ingestion), and polyuria (increased urination caused by osmotic diuresis). Other striking features include the presence of glucose and ketone bodies in the urine. Fatigue with weakness, irritability, blurred vision, numbness or tingling sensations in the hands

and feet are also present.

### Musculoskeletal Complications

Diabetes may affect the musculoskeletal system in a variety of ways. Musculoskeletal complications are most commonly seen in patients with a longstanding history of type 1 diabetes, but they are also seen in patients with type 2 diabetes. Some of the complications have a known direct association with diabetes, whereas others have a suggested but unproven association.

#### Hands

Hands are a target for several diabetes-related complications. Diabetic cheiroarthropathy, also known as diabetic stiff hand syndrome or limited joint mobility syndrome, is found in 8–50% of all patients with type 1 diabetes and is also seen in type 2 diabetic patients. The prevalence increases with duration of diabetes. This condition is associated with and predictive of other diabetic complications.

This syndrome is characterized by thick, tight, waxy skin reminiscent of scleroderma. Limited joint range of motion (inability to fully flex or extend the fingers) and sclerosis of tendon sheaths are also seen. The underlying cause is thought to be multifactorial. Flexion contractures of the fingers may develop at advanced stages. One indication of the presence of this condition is known as the "prayer sign". This is patients' inability to press their palms together completely without a gap remaining between opposed palms and fingers.

Flexor tenosynovitis (or trigger finger) is another frequent diabetic complication of the hands. Patients complain of a catching sensation or locking phenomenon that may be associated with pain in the affected fingers. Examination shows a palpable nodule, usually in the area overlying the metacarpophalangeal joint, and thickening along the affected flexor tendon sheath on the palmar aspect of the finger and hand. Also, the locking phenomenon may be reproduced with either active or passive finger flexion.

Dupuytren's contracture results from a thickening, shortening, and fibrosis of the palmar fascia. Nodule formation along the fascia is seen. Flexion contractures of the fingers may result, usually at the fourth finger, but sometimes involving any of the second through fifth digits. Dupuytren's contracture has been reported in 16–42% of diabetic patients.

Carpal tunnel syndrome (CTS) is seen in up to 20% of diabetic patients. Its specific relationship to diabetes is thought to be median nerve entrapment caused by the diabetes-induced connective tissue

changes. The prevalence of CTS in diabetic patients generally increases with duration of diabetes. Patients complain of burning, paresthesias, or sensory loss in the median nerve distribution (the first three fingers as well as the radial half of the fourth finger). They may also complain of pain in the same area, often with radiation proximally into the forearm and arm. The pain may awaken patients from sleep and is aggravated by activities involving wrist flexion or extension, such as holding a newspaper or book, typing, driving, or using a knife and fork.

### Shoulders

Diabetes can affect the shoulder in several ways. First, adhesive capsulitis, or frozen shoulder, has been reported in 19% of diabetic patients. This term refers to a stiffened glenohumeral joint usually caused by a reversible contraction of the joint capsule. Patients report shoulder stiffness, along with decreased range of motion.

Calcific periarthritis of the shoulder is also seen in diabetes, where it is roughly three times more common than in people without diabetes. Shoulder radiographs show calcium deposits outside of the joint, often in the area of the rotator cuff tendons. However, in up to two-thirds of the cases, this condition is asymptomatic in patients with diabetes. Reflex sympathetic dystrophy, also known as "shoulder-hand syndrome," is seen in diabetic patients. It may be associated with adhesive capsulitis (with or without calcific periarthritis). Patients may complain of pain from shoulder to hand in the affected limb. Classical examination findings include swelling of the affected limb/area,

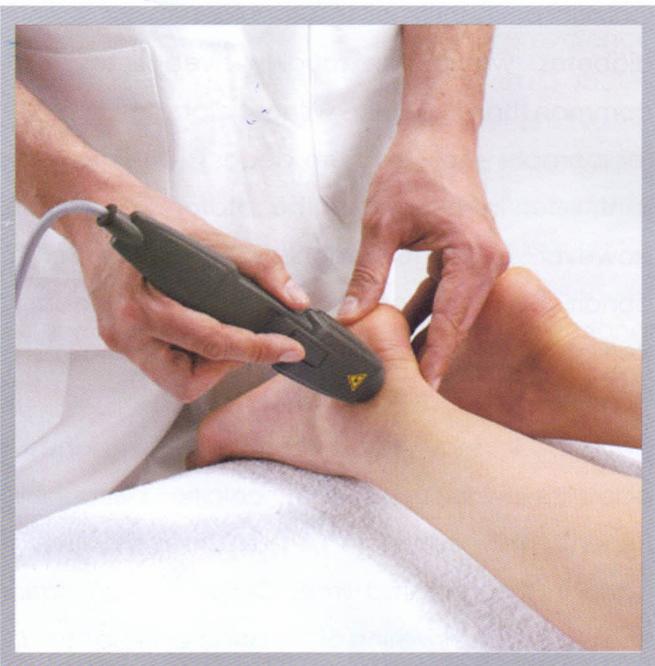
skin changes (changes in hair growth, shiny skin, color and temperature changes), increased sensitivity to temperature and touch (hyperesthesia), and vasomotor instability. Transient, patchy osteoporosis is also often seen.

### Feet

Diabetic osteoarthropathy (also known as Charcot or neuropathic arthropathy) is a condition involving destructive, lytic joint changes. It is a severe, destructive form of degenerative arthritis resulting from a loss of sensation (brought on by underlying diabetic neuropathy) in the involved joints. It most commonly affects the pedal bones. Loss of sensation leads to inadvertent (and unnoticed) repeated microtrauma to the joints, which leads to degenerative changes. Physical examination will invariably demonstrate peripheral neuropathy. There may be skin such as erythema, swelling, hyperpigmentation or purpura, and soft-tissue ulcers over the affected area, as well as joint loosening or instability and joint deformities.

### Muscles

Diabetic muscle infarction is a rare condition. This spontaneous infarction, with no history of trauma, tends to affect patients with a long history of poorly



controlled diabetes. It is seen more commonly in patients with insulin-requiring diabetes, and most affected patients have multiple microvascular complications (neuropathy, nephropathy, and retinopathy). The clinical presentation is an acute onset of pain and swelling over days to weeks in the affected muscle groups (usually the thigh or calf) along with varying degrees of tenderness. Spontaneous diabetic muscle infarction tends to resolve over a period of weeks to months in most cases.

### Skeleton

Diffuse idiopathic skeletal hyperostosis (DISH) is characterized by metaplastic calcification of spinal ligaments (diagnosed on lateral spine radiographs) along with osteophyte formation. However, disc spaces, apophyseal joints, and sacroiliac joints are unaffected. The thoracic spine is most commonly affected. It may be accompanied by a more generalized calcification of other extra-axial ligaments and tendons, as well. The underlying pathophysiology is not understood. DISH has a higher prevalence among diabetic patients than among people without diabetes. Specifically, it is commonly seen in association with type 2 diabetes, particularly in obese patients. Patients complain of stiffness in the neck and back with decreased range of motion. Pain is generally not a prominent symptom. Treatment consists of physical therapy and analgesics.

### Osteoarthritis

Diabetes is not clearly a risk factor for osteoarthritis (OA). However, obesity is a risk factor for both conditions. Several studies have reported an association of early OA and diabetes. Both large and small joint OA have been reported to be increased in type 2 diabetes. However, OA of the

weight-bearing joints in the affected type 2 diabetic patients may be related to their obesity and not to the diabetes itself. It is not yet known whether diabetes is a risk factor for OA independent of obesity. Diabetes quite commonly affects the musculo-skeletal system, resulting in significant morbidity. These manifestations may go unrecognized or simply be overlooked in daily clinical practice. However, many of these rheumatological complications are treatable through physiotherapy which results improvements in quality of life and more independence in activities of daily living.

### Neurological Complications

Patients with diabetes, peripheral neuropathy is one of the most debilitating complications. Patients experience losses in sensation, balance, and walking ability, and they are at greater risk for foot ulceration and falls. Fortunately, patients can combat and even prevent diabetic peripheral neuropathy by following a regular exercise routine. Aerobic exercises, such as running or swimming, strength training exercises, functional training, and Tai chi have all been shown to improve symptoms, whether by decreasing pain and neuropathic symptoms or by increasing function and nerve conduction. In addition, exercise improves glucose control and combats other complications related to diabetes, such as obesity and hypertension, thus making it a cornerstone of any diabetic patient's

treatment.

Peripheral neuropathy is a serious complication of diabetes that affects nearly 50% of diabetic patients. It is the most common form of neuropathy, and it can present in numerous ways: symmetric or asymmetric, autonomic or peripheral, sensory or somatic. Patients can suffer from burning, stabbing, or tingling sensations, eventually progressing to muscle weakness and painless numbness.

### Cardiorespiratory Complications

Diabetes mellitus produces serious complications in several major organ systems. It is well established that coronary artery disease is major complication of Diabetes, representing the ultimate cause of death in more than half of all patients with disease. Furthermore, Myocardial Infarction in diabetic patients usually is more extensive and more severe than in non-diabetic patients. The long term survival rate after acute myocardial infarction among diabetic patients is also lower than that among non-diabetic patients. Other studies also demonstrated that in diabetic patients, the incidence of painless myocardial infarction is higher than in non-diabetic patients. The pulmonary complications, although uncommon and not well recognized, may be life-threatening. The pulmonary complications described in patients with diabetes include pulmonary edema, disordered breathing during sleep, and reductions in elastic recoil of the lungs, diffusing capacity of the lungs for carbon monoxide,



and bronchomotor tone. Other reported complications are respiratory alkalosis, cardiorespiratory arrest, pneumothorax, pneumomediastinum, plugging of the airways with mucus, and aspiration pneumonia attributable to diabetic gastroparesis.

A low cardiorespiratory fitness level is an important risk factor for incidence of type 2 diabetes among people. Although cardiorespiratory fitness is a highly objective parameter, it is not readily measured. Therefore, few studies have investigated the relationship between cardiorespiratory fitness and the incidence of type 2 diabetes. For example, individuals with low cardiorespiratory fitness have high insulin resistance. By maintaining a high cardiorespiratory fitness level may contribute to the prevention of type 2 diabetes

Physical therapists are encouraged to incorporate evidence-based physical activity counseling techniques in their practice to assist patients with diabetes in improving glycemic control and cardiorespiratory fitness.



### **Physical Therapy Management**

Physical therapy is an ancient science, which involves physical treatment techniques such as mechanical agents and electrotherapeutic agents rather than drug therapy for the management of a condition. Physiotherapists play an important role in helping people to overcome disability and pain related to orthopedic, musculoskeletal, neurological and rheumatological illnesses.

Physiotherapists are able to help people to plan an individualized exercise program in order to maintain good blood glucose control and achieve optimal weight. Effective exercise counselling ensures both Cardio-respiratory and Musculoskeletal fitness. This helps people with diabetes improve their quality of

life and contributes to overall control of blood glucose.

Physiotherapists with their knowledge of physiology and anatomy can suggest specific exercise for people with coexisting complications, cautioning against certain movements that might be detrimental to their health. For example, an isotonic exercise like jogging will benefit a person with high blood glucose or Diabetes, but the repeated foot trauma associated with jogging may harm someone with peripheral sensory neuropathy or Charcot foot.

In all these conditions, physiotherapy plays a pivotal role in returning people to normal levels of health and well being. The physiotherapist uses a combination of active and passive exercises, and mechanical and electrical aids to improve musculoskeletal, neurological and cardio-respiratory functions.

Physiotherapy offers various effective non pharmacological approaches for pain relief. Transcutaneous electrical nerve stimulations (TENS) involves electrical nerve stimulation through skin, sending a painless current to specific nerves. The mild electrical current generates heat that serves to relieve pain. Interferential therapy (IFT) uses the strong physiological effects of low frequency of electrical stimulation of nerves. Other modalities, such as ultrasonic therapy and hot wax are useful for specific conditions in both people with diabetes and people without the condition.

As the number of people with diabetes continues to rise and as the existing diabetes population ages, the need for efficient physical therapy services will continue to grow. Including specialised physical therapists as equal members of the diabetes care team will help us to utilize their services effectively in order to improve the health and well being of all people with Diabetes.

### **Department of Physiotherapy**