

# Taking a Stand on Falls in the Person with Diabetes—Part 2

Having a suitable fall prevention strategy will optimize the quality of life for your diabetic patient.

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***Author's Note:** Part 1 of this article emphasized the importance of including the topic of falls when discussing diabetes, its challenges and sequelae, the reasons why falls among the elderly occur, and how diabetes enhances those causative factors. In part 2 we will address the functional, biomechanical and therapeutic aspects of an ideal fall prevention strategy.*

## **Postural Hypotension**

Postural hypotension can certainly be a factor in falls that are associated with standing up quickly or stretching; and research has shown that this condition is associated with autonomic neuropathy and therefore more prevalent in those with diabetes.<sup>1,2</sup> Interestingly, there is only weak evidence that postural hypotension is a risk factor for falls in broader or more general populations.<sup>3,4</sup>

## **Lateral Instability**

Inability to control lateral stability, that is, not having the ability to move appropriately from side to side when needed, as in getting out of a car, is a key factor in diabetes-related falls. This is a testament to the weakness of the gluteus muscles signaling the presence of proximal diabetic neuropathy, a manifestation of motor neuropathy. Proximal diabetic neuropathy is one of the most disabling forms of peripheral neuropathy, characterized by se-

vere, initially asymmetric leg pain and weakness. The disease usually progresses to a bilateral state within three months of the abrupt onset. Initially, muscles develop weakness in one leg and/or thigh and then over a relatively short period of time the other lower limb segments become involved accompanied by more widespread weakness. More specifically, the progression starts

ported that weakness of the leg muscles was identified as the most potent risk factor associated with falls, increasing the odds of falling by more than four times. Individuals who have fallen have a threefold increased risk of falling again. Although recurrent falls in an individual are usually due to the same underlying cause (i.e., gait disorder, orthostatic hypotension), they

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with pain shifting to the muscles in the proximal portion of the lower extremity, such as the vastus lateralis, the adductor muscles of the thigh, and the gluteal muscles of the hip. This condition can begin with distal symptoms but in almost all cases, both proximal and distal muscles are involved. The pain and the weakness in this condition represents a significant risk factor for falls in the diabetic; and the activities most commonly involved highlight the use of the very muscles affected by this disorder.

## **Lower and Upper Body Weakness**

Applicable to the diabetic population, in other studies<sup>5</sup> it is re-

ported that weakness of the leg muscles was identified as the most potent risk factor associated with falls, increasing the odds of falling by more than four times. Individuals who have fallen have a threefold increased risk of falling again. Although recurrent falls in an individual are usually due to the same underlying cause (i.e., gait disorder, orthostatic hypotension), they

can also signify disease progression (e.g., worsening diabetes, dementia) or a new acute problem (e.g., infection, dehydration).<sup>6</sup>

The never-safe high-risk activities previously mentioned (i.e., getting up from a chair or wheelchair, sofa, toilet, getting out of a car, grabbing a bannister up or down stairs for support) are all actions that could prompt a person with sensorimotor neuropathy to fall. The muscles that need to be employed here include not only the flexors of the feet, the gastroc-soleus group, the quadriceps, hamstrings, hip adductors, hip abductors, gluteus maximus, abdominals, and extensors

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of the lower back, but upper body muscles as well. These situations require more upper body strength for lifting up and holding on; and the shoulder, triceps, wrist extensors, hand flexors, pectorals and scapular musculature would be included in the list of muscles that are required to facilitate the appropriate movements involved.

## Neuropathy and Other Conditions

Clearly then, not only lower extremity weakness but upper body

weakness as well will predispose a person for a fall. Therefore, to emphasize a point, any diabetic neurop-

symptoms of diabetic neuropathy often begin with the lower extremities, which then progress to a stock-

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athy affecting the upper extremity is considered a substantial risk factor for falls.

It should be noted that clinical

ing-glove distribution where the upper extremity is affected. When diabetes is left untreated the upper extremity is affected by a disturbance in proprioception and then, as the disease progresses, is followed by abnormal muscle function and weakness.

Besides diabetic neuropathy, there are other conditions that affect the hands of a person with diabetes mellitus, and which thus unquestionably pose a fall risk. Carpal and cubital tunnel syndrome and some forms of stenosing tenosynovitis must be included in this grouping.

Whatever activity is employed at the time leading up to the fall, factors that stabilize and control the foot in gait act in concert with the aforementioned musculature of the total body. With this in mind, the detrimental effect of peripheral neuropathy is further established as a risk factor for injuries and falls during gait. In addition to the aspects of sensory and proprioceptive loss of sensation discussed above, the effects of motor neuropathy on the feet should also be highlighted.

Motor neuropathy affects nerves to the muscles that control the motions of the foot, leading to changes in foot structure and different patterns of weight bearing, very often resulting in an propulsive stepage gait. Initially, the loss of motor innervation starts in the small intrinsic musculature of the foot, first resulting in atrophy that eventually can progress to complete paralysis of this muscle group. The effect of this destructive process is the loss of the stabilizing effect the intrinsic muscle groups provide during stance and gait. This results in contracted digits with retrograde

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## Podiatrists: Using Their Skill Set to Help in Fall Prevention

**T**he idea is not new: that the podiatric community needs to be part of the team that supports fall prevention. This concept has been promoted by many in the podiatric community, among them:

**Dr. Earl Horowitz**, medical director of the Diabetic Foot Wound Center in Jacksonville, Florida, and president of the American Board of Multiple Specialties in Podiatry, states that “It is time the podiatric physician uses his/her skill set to help prevent falls in this very vulnerable population. It is an opportunity and an obligation!”

**Dr. Doug Richie**, Adjunct Associate Professor in the Department of Applied Biomechanics at the California School of Podiatric Medicine at Samuel Merritt University, and Past President of the American Academy of Podiatric Sports Medicine, comments: “It is important for the podiatric physician to recognize his or her role as a member of a healthcare team in treating this vital public health issue. By following sound, scientifically proven guidelines, there is significant opportunity for podiatric physicians to become key players on the fall prevention team, which will improve the quality of life of their elderly patients.”

**Dr. Art Helfand**, recognized by world leaders in musculoskeletal research in falls, gives insight to DPM’s treating and preventing balance issues and falls in people with diabetes mellitus. He called for podiatric physicians to realize their role in fall prevention in his landmark article in the Journal of the American Podiatric Medical Association in 1966. Dr. Helfand’s remarkably prophetic article produces evidence supporting the link between foot problems, footwear and balance impairment. He stated that “podiatric physicians should own the role of the fall prevention specialist within the burgeoning area of geriatric podiatric medicine.” •

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forces being placed on the metatarsal heads, thereby reducing weight bearing on the toes. This classic high-risk “intrinsic minus” foot, together with nonenzymatic glycosylation of the joints in the foot and ankle that limit joint mobility, is clearly off balance; and this situation presents a major risk factor for falls in the person with diabetic neuropathy.

## **Renal Function and Vitamin D**

Rounding off the list of significant contributors to fall risk in the diabetic population, poor renal function and the resultant lower levels of active vitamin D must be considered for inclusion. Recently it's been reported that poor renal function is a risk factor for falls in older adults with diabetes.<sup>7</sup> The study found a linear association between fall risk and Cystatin C, a measurement of glomerular filtration rate, suggesting that even modest declines in renal function are a risk factor for falls. A previous report linked Cystatin C to gait, balance and strength in diabetic individuals.<sup>8</sup> The mechanism of action here is that poorer renal function leads to lower levels of active vitamin D, which may contribute to falls through reduced muscle strength and nerve function.

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### **Prevention and the “Whole Person”**

In this report so far, we have discussed a number of mechanisms by which DM may contribute to falls. One would be remiss, however, in covering this subject without talking about prevention. Avoidance of a fall requires more than just adjudicating contributory external factors and environmental

hazards. The intricate balance of relevant muscle groups and how they relate to the mechanisms of falling is something that physical therapists work with every day. Terri Brusseau Kraus, a physical therapist in the North County San Diego area, is well known for her expertise in fall prevention, especially as it relates to the person with diabetes. She states that fall prevention is a complex issue that requires regard for the whole person.<sup>9</sup> The most important factors are posture, body mechanics,

range of motion and attending to potential and current diabetic complications such as neuropathy, poor vision and gait issues.

Addressing postural issues commonly involves fighting gravity when we shift our weight anteriorly. This causes a shuffling gait that prevents us from lifting our feet. This anterior weight shifting makes stopping the forward momentum difficult and falls can easily occur.

Focusing on body mechanics is equally essential to the prevention of falls. Transitional moves such

proving balance and diminishing falls. People must be taught to use their gluteus maximus and hamstrings for leg and hip extension and to build their gastrocnemius and soleus to assist in controlling gait, especially when descending curbs or stairs. In gait, stance and transitional movement, gluteus medius and transverse abdominal strength are crucial for hip control and maximizing power generation of the legs and spinal endurance used in stance and upright posture.

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## **DPM's have a unique skill set and an opportunity to be an invaluable asset to any fall prevention approach.**

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Hip adductors should also be emphasized to centralize balance. Increasing a person's lower extremity as well as abdominal muscle strength allows the body to hold a steadier stance with less effort.

Proper range of motion in the back and lower extremities allow people to more easily stack their body weight over their feet and allow their core to work more efficiently.

With these considerations in place, the foot and the rest of the body could become symbiotic and biomechanically stable; picking up his/her feet is improved, weight shifting is enhanced, balance is optimized, and fall risk is diminished.

### **Summary**

In summary, it must be stressed that people with diabetes mellitus have a rather significant risk of falling due to having the disease itself, and because of the contributory effects that the complications have on gait. The best treatment here is prevention of the fall. This task is multifaceted and should incorporate personal environmental concerns, managing blood sugars, controlling blood pressure as well as other medical and behavioral concerns, and being aware of neuropathic problems; and most importantly, a proactive attitude that encourages preventive strate-

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gies, applicable exercises and gainful movements.

Podiatric physicians have a unique skill set and an opportunity to be an invaluable asset to any fall prevention approach, and to help head off this catastrophic trend of falling which is part and parcel of a dramatic increase in diabetes coupled with an equally explosive and concerning trend of a never-before-seen aging population. **PM**

## References

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<sup>6</sup> Elderly Falls Prevention Legislation and Statutes. [www.ncsl.org/research/health/elderly-falls-prevention-legislation-and-statutes.aspx](http://www.ncsl.org/research/health/elderly-falls-prevention-legislation-and-statutes.aspx).

<sup>7</sup> Osteoporos Int. 2005;16:332-338. A new significant and independent risk factor for falls in elderly men and women: a low creatinine clearance of less than 65 ml/min. Dukas LC, Schacht

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<sup>9</sup> Personal Interviews with Terri Brusseau Kraus, M. PT. 7/28/16 2 hours. 8/08/16 1 hour. 8/10/16 1.5 hour. Location: Office: Atala Physical Therapy, 3222 Grey Hawk Court, Carlsbad, California 92010.



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