



## **Impact Of Diabetic Peripheral Neuropathy, Hypoglycemic Attack, Diabetic Foot and Associated Fall Risks in Diabetic Mellitus:A Review of Literature**

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### **ABSTRACT**

Falls are a major cause of detriment and a preventable cause of death in older people. Diabetes mellitus prevalence increases with age. The prevalence of falls is higher in diabetic elderly patients.[1]. These falls have a significant impact on the patient, as well as increasing the duration of stay in the hospital and the expense of care.[23].Incidence of falls was positively associated with increased age, longer duration of diabetes, treatment with insulin therapy and sulfonylureas, poor diabetic control, polypharmacy, decreased mobility, peripheral neuropathy, osteoarthritis, retinopathy, living alone, living in a care home, smoking and excess alcohol consumption.[1]To achieve optimal glycemic control and manage diabetes successfully in patients with diabetes, Hypoglycemia may be a major barrier. Falls are the foremost significant consequences caused by hypoglycemia episodes. Both hypoglycemia and falls result in a substantial economic burden on the health care system within US.[2] Achieving lower A1C levels with oral hypoglycemic medications wasn't related to more frequent falls, but among those using insulin, A1C  $\leq$ 6% increased fall risk.[3]. Increased postural swing and substantial loss of postural control have been found in DPN patients with reduced plantar sensitivity and increased the chance of falls in the DM group.[1]. The risk of falls increases by 52-81% in DM patients. Patients with Diabetic Foot Ulcer (DFU) are at greater risk of falls than patients with DM without DFU.[4]. The Women's Health and Aging Study found that poor lower extremity function, including a test of balance, was a risk factor for recurrent falls in participants with diabetes.[5]. Information on the risk of diabetes-related falls in younger diabetics would help reduce the overall health burdens associated with falls in diabetic populations, as the incidence and prevalence of diabetes are rising in younger age groups. Fear of falling and associated activity restriction modify the relationship between risk factors and falls and are more prevalent in diabetes. The assessment and management of fear of falling are indicated in studies of fall risk in diabetes. We determined if diabetes-related complications or treatments are related to falling risk in older diabetic adults.[6]

Keywords:Falls, Elderly, Diabetic Peripheral Neuropathy(DPN), Diabetic Foot Ulcer(DFU), Hypoglycemia.

### **1. Introduction**

Fall is the second leading cause of accidental or unintentional injury-induced deaths worldwide, with a significant social and economic burden, and can have a variety of serious consequences of varying severity. A growing body of evidence suggests that patients with type 2 diabetes have a higher risk of falling than healthy people. The risk of falling increases with age, and those in their middle and later years are at the greatest risk. Every year, one-third of adults over the age of 65 and one-half of adults over the age of 80 are estimated to die. Around 37.3 million falls per year were severe enough to necessitate medical attention, resulting in the loss of over 17 million disability-adjusted life years (1). Few studies, however, have looked at the prevalence and risk factors of falls in middle-aged and older people. As a result, it's critical to look into the modifiable risk factors for falls in this population. People with diabetes, on the other hand, had higher bone mineral density than the general population, which is thought to be a protective factor against fall-related fractures. The 'diabetes bone paradox' suggests that there are other factors that contribute to a higher risk of falling in diabetic patients. As a result,

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identifying the risk factors for diabetic patients falling is critical. Several common risk factors have been identified.[7]. The underlying processes might be connected to diabetes-related clinical alterations such as vestibular dysfunction, peripheral neuropathy, diabetic retinopathy, muscular weakness, and severe hypoglycemic crises caused by insulin usage.[21]

Hypoglycemia from medicines, autonomic neuropathy, peripheral sensory neuropathy, and vision impairment all increase the risk of falling in older persons with diabetes. The ankles and feet show the most progressive loss of feeling and joint position perception. As a result, decreased mobility raises the danger of falling, particularly while walking on uneven ground. [24]. Hyperglycemia in diabetics can lead to skeletal muscle mitochondrial dysfunction, which can lead to muscle weakness and poor quality, as well as a negative impact on the somatosensory, visual, and vestibular systems, as well as the cognitive system. Hyperglycemia's negative effects increase the risk of falling.[8].

Diabetes causes people to age more quickly, putting them at a higher chance of acquiring frailty syndrome earlier than non-diabetic people.[22]. Gait is a frequent yet difficult action that necessitates the integration of the neurological, musculoskeletal, and cardiovascular systems. Falls and immobility are linked to gait abnormalities, which lead to increased disability and institutionalization, as well as higher health-care expenses and death.[21]. Neuropathy, polypharmacy, cognitive impairment, peripheral arterial disease, vision loss, hypoglycemia, and insulin therapy are all possible diabetes-related risk factors for falls.[6]. Fear of falling is an important psychological symptom in diabetes that has received little research. Fear of falling is linked to falls and injuries, most likely due to activity restriction and subsequent deconditioning. [6] Given the high rate of balance and gait impairments, fear of falling may be more common in diabetics. [6] Diabetes patients had higher rates of obesity, neuropathy, and microalbuminuria; they were more likely to be on antihypertensive medications; they drank less alcohol and performed worse on the TUG test.[9]. The increased fear of falling in diabetics is most likely due to increased balance and mobility impairments, but it could also be linked to other factors such as obesity, depression, and diabetes-related complications.[6].

Diabetes is linked to an increased risk of falling, particularly in insulin users. The general population had a higher rate of serious injury from a low-trauma fall than those with insulin-treated diabetes. This increased risk of fall-related injuries among diabetics on insulin could be due to the fact that diabetics on insulin have more severe comorbidities, such as peripheral vascular disease and peripheral neuropathy, which affect proprioception and leg function, when compared to diabetics who are not on insulin. More frequent fainting, poorer balance, decreased renal function, and polypharmacy, which we identified as intermediaries in the link between insulin-treated diabetes and an increased risk of injurious falls, have all been identified as risk factors for falls or fall injuries in broader populations of older adults in previous studies. Patients with diabetes mellitus with or without peripheral neuropathy should have their risk of a hypoglycemic attack, diabetic foot ulcers, and falls assessed.[5].

Fall-related deaths are the second leading cause of death globally. 1 It is responsible for over 15 million disability claims and 11% of unintentional injury-related deaths. -life-years adjusted annually [2] A higher risk of falls in diabetics has been linked to poor glycemic control (glycosylated hemoglobin A1c [HbA1c] >7%) and a higher prevalence of complications such as visual impairment and peripheral neuropathy.[10]. T2DM is a chronic disease that affects more than 347 million people around the world. It increases the risk of death twofold, making it a major global concern.[2] Glucotoxicity, chronic inflammation, and microvascular alterations have been suggested to be significant variables in accelerating bone aging and the advancement of diabetic bone disease in individuals with T1DM and T2DM with advanced illness. Non-skeletal variables, such as persistent diabetes problems, comorbidities, and pharmacological side effects, may further raise the risk of falling.[27].

### 1.1 Diabetic Peripheral Neuropathy and Its Impact

Diabetic peripheral neuropathy is thought to account for approximately 27% of diabetes-related healthcare costs (DPN). DPN is the most common diabetic complication, and it causes a wide range of neuropathic complications, both acute and chronic, affecting all levels of the peripheral nerves. With a lifetime prevalence of around 50%, DPN is the most common diabetic complication. Increased postural sway and substantial loss of postural control have been found in DPN patients with reduced plantar sensitivity and increased the chance of falls in the DM group. DPN is a leading cause of disability due to foot ulceration and amputation, gait disturbance, and fall-related injury. Neuropathic pain affects roughly 20% to 30% of DPN patients.[11]. Furthermore, obese people with peripheral neuropathy for a variety of reasons tend to be at the highest risk of falling.[28]

Hypoxia has been proposed as a possible cause of diabetic polyneuropathy caused by nerve ischemia, which is thought to be caused by a thickening of the vessels that perfuse peripheral nerves. In nerve biopsies, the basement membrane of the capillaries that supply nutrients thicken. Furthermore, the lumen's diameter is decreasing. A physiological shunt may occur in the early stages of the disease, resulting in hypoxia in the absence of obvious signs of ischemia. [11].When compared to people without diabetes, diabetic peripheral neuropathy (DPN) causes significant unsteadiness during gait, increasing the risk of falling 20-fold. It also shows that DPN patients are aware of their unsteadiness and try to self-regulate it by walking more slowly and carefully [12]. Diabetic neuropathy has been linked to a higher risk of falling in earlier research, and has been linked to decreased ankle strength, balance recovery, and walking stability in diabetic individuals.[30]. DPN has a negative impact on quality of life and increases diabetes-related healthcare costs significantly [11].

### 1.2 Effect Of Hypoglycemia

Hypoglycemia is a key barrier to diabetic people maintaining adequate glycemic control and successfully treating their diabetes. Hypoglycemia has the most catastrophic consequences: falls. Hypoglycemia and falls put a substantial financial load on the healthcare system in the United States. There is currently limited evidence in the United States of a relationship between hypoglycemia and fall-related events in older diabetes patients. [2]. The effect of repeated episodes of iatrogenic hypoglycemia, which weakens the autonomic response to recurrent hypoglycemia, must be considered. The glycemic threshold is reset to a lower glucose level, and the subject's capacity to detect the start of hypoglycemia symptoms is reduced. Many people with long-term insulin-treated diabetes have poor hypoglycemia awareness, according to clinical experience. Hypoglycemia has been associated with cognitive impairment, including reduced hypoglycemia awareness.[25]. Oral diabetes drugs are used to keep diabetic patients' glycemic levels under control, although some have been related to an increased risk of hypoglycemia.[2]. Insulin secretagogues, such as sulfonylureas, are known to produce hypoglycemia; however, the causal link between these medicines and fracture risk has yet to be shown.[9]

Hypoglycemia can cause severe falls, strokes, cardiovascular events, and even death. [13] Hypoglycemia is related to an increased risk of morbidity and mortality [2]. Patients with diabetes were more likely to fall. Severe hypoglycemia was also linked to a higher risk of diabetes, with the increased risks being especially prominent in persons under 65 years old [10].

Although strict glycemic management can help prevent or delay ocular problems and neuropathy, a lower HbA1c level is associated with a higher risk of severe hypoglycemia [10]. Higher glucose variability and lower average glucose levels in type 2 diabetes patients over 65 suggest a higher risk of hypoglycemia. To avoid hypoglycemia, it is vital to maintain complete blood glucose management in such individuals.[13]

### 1.3 The Impact of Diabetic Foot

Diabetic foot ulcers (DFU) are one of the most common problems in DM patients and 15-20% of them cause amputation. Sores on diabetic feet are a major complication of DM as they cause an increase in morbidity and mortality and affect the quality of life. The International Diabetes Federation estimates that every 30 seconds, at least one DM patient's limb is amputated because of DFU. Patients with DFU had twice the mortality rate compared with non-diabetic patients. Long-term DFU requires long-term medical care and disability due to amputation. In addition, the cost of DFU treatment is expensive.[4].

A few things are caused by the appearance of DFU in DM patients. Some of these symptoms include neuropathy, leg pain, and peripheral vascular disease. Diabetic peripheral neuropathy puts DM patients at risk of developing DFU due to the reduced role of the foot nerve. Dangerous risk factors include the age and duration of DM ( $\geq 10$  years). Although risk factors that change include neuropathy (nerve, motor, peripheral), obesity, high blood pressure, uncontrolled levels of glycated hemoglobin (HbA1c) and blood sugar, smoking habits, DM diet failure, lack of exercise body, poor foot care, and improper use of footwear. The risk of falls increases by 52-81% in DM patients. Patients with DFU are at greater risk of falls than patients with DM without DFU.[4]. Diabetic foot problems contribute to the death and illness of people with diabetes leading to a greater physical, physical and financial burden on patients and society as a whole. It is estimated that 24.4% of the total cost of health care among people with diabetes is related to foot problems.[14]

Patients living with DFU have a lower standard of living, which can lead to decreased activity, social isolation, sleep disturbances, reduced productivity, pain, and depression, which in turn contributes to an increased risk of falls. Therefore, nurses need to evaluate DFU-related risk factors and identify risk factors for patients with DM with or without DFU in order to diagnose and treat DFU early to reduce complications, reduce the risk of falls, and increase the quality of life. Dangerous features of DFU will be evaluated because DFU can reduce physical activity in patients with DM, result in lower glycemic control, and increase the risk of falls.[4]

The risk of ulcers and amputation among diabetic patients doubles by four years with diabetes mellitus regardless of type. It has also been proven by many longitudinal epidemiological studies that among patients with diabetes, the risk of life-threatening foot ulcers is about 25%, thus accounting for two-thirds of all non-traumatic amputations.[15]. Sores on the feet are a preventable condition, where a simple intervention can reduce amputation by up to 70% with programs that can reduce your risk factors. Identifying the role of risk factors contributing to this situation will enable health care providers to establish better prevention programs that may result in improved patient quality of life from now on, reducing the economic burden on both the patient and the health care system.[16]

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## 2. Conclusion

Diabetic patients are at a higher risk of falling than non-diabetic patients, regardless of whether they have a serious medical history. A history of severe hypoglycemia further increased the risk of diabetic falls, and this increased risk was especially noticeable in young patients (65 years old) with diabetes mellitus. Severe hypoglycemic-related falls in young diabetics lead to loss of work and interfere with family functions, and hence we should pay special attention to the prevention of falls in young patients (those under the age of 65).[10]. The risk of fall-related events are high in Elderly diabetic patients

experiencing hypoglycemia. This emphasizes the need to take precautions to prevent the incidence of hypoglycemia in elderly diabetic patients. This may reduce fall-related events.[10]

Frailty plays a crucial role in the risk factors of falls in patients with type 2 diabetes, with higher effects seen in at-risk subgroups.[17]. An individual with type 2 diabetes was found to be substantially frailer than those without the disease. Frailty raises the risk of fragility fractures and amplifies the impact of diabetes on these fractures.[26]. Obesity, diabetes, hypertension, and hyperlipidemia result in alterations in the nervous endocrine system activity. These are also some of the most important factors in chronic kidney disease triggering nocturia. Moreover, these comorbidities require medications such as diuretics, which can cause or exacerbate nocturia. Nocturia has become a mess of various problems, such as increased fatigue, naps, traffic accidents, and nightfall. The risk of the latter is mainly related to the fact that falling in the elderly is associated with an increase in morbidity and mortality.[18]

Most of the covariates are identified as contributors to the risk of falls and fractures is a chronic disease condition that can only be treated symptomatically. However, covariates like – beer include drug intake, hypoglycemia, and Use of TCA / GABA analog – potentially avoidable and aimed to reduce the risk of falls and fractures in older DPNs patients. In elderly men and women with type 2 diabetes, sulfonylureas have been linked to an increased risk of hip fracture.[9]. Hypoglycemia can be prevented by avoiding insulin and insulin secretagogues and the risk associated with the use of TCA / GABA analogs cannot be ruled out easily. The major alternatives opioids and duloxetine are problematic in fall and fracture risk. Therefore, a significant need for the elderly DPN patient population, a solution for pain management that does not contribute to falls in a patient population already prone to balance problems.[19]

Type 2 diabetes is linked to an increased fear of falling and fear-related activity restriction, which reduces the risk of falling even when other risk factors such as mobility are present. Fear of falling is a key modulator of the link between risk variables and falls in future investigations of diabetes falls.[6]. Multifaceted therapies aimed at improving health and function in diabetics may assist to lower the likelihood of gait problems and eventual impairment.[20] As a result, it's critical to look at the extent to which older people with diabetes have a higher risk of falling and to identify diabetes and fall-related issues that may be addressed.[29].

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