International Journal of Advances in Medicine
Amin OSM et al. Int J Adv Med. 2019 Jun;6(3):605-610
http://www.ijmedicine.com
pISSN 2349-3925 | eISSN 2349-3933
DOI: http://dx.doi.org/10.18203/2349-3933.ijam20192236

Original Research Article

Analysis of risk factors for falls in geriatric patients: a single institutional experience

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Received: 03 February 2019
Accepted: 12 March 2019

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ABSTRACT

Background: In elderly people, falls have been recognized as one of the major causes of disability and potentially preventable mortality. Authors analyzed the incidence of falls in elderly diabetic people who have been receiving insulin therapy versus those on oral hypoglycaemic agents (OHGAs).
Methods: This observational study was conducted at the department of neurology of Shorsh military general teaching hospital and its outpatients' department, Iraq, from April 1st to September 30st, 2016. A total of 100 diabetic patients older than 65 years of age, who had a history of one or more falls, were included in the study. The duration of diabetes, mode of its treatment, and its complications all were analyzed in addition to the risk factors for falls.
Results: Females (n=57) outnumbered males (n=43) and the mean age of the patients was (71.2±3.6) years. Increasing patient's age, long-standing diabetes, poor glycaemic control, insulin therapy, and polypharmacy (of 3 and more antidiabetic agents) were significantly and statistically encountered and associated parameters for the risk of falls. The presence of additional risk factors for falls (e.g., previous stroke, alcoholism, cardiac dysrhythmia, and osteoarthrosis) augmented this risk.
Conclusions: Diabetes and its treatment render older people more liable for falls. The longer duration of the disease and the higher patients' age (which were the commonest risks) are irreversible and non-correctable parameters for falls. Further analytic studies are required to unveil the role of each risk factor authors have detected.

Keywords: Diabetes, Elderly, Fall

INTRODUCTION

A fall is defined as "unintentionally coming to the ground or some lower level and other than as a consequence of sustaining a violent blow, loss of consciousness, sudden onset of paralysis as in stroke or an epileptic seizure.[1] Although falls can occur at all ages, the frequency and severity of fall-related injuries increase with age; the term "older person" or elderly has been used to refer to people aged 65 years and older.[2] Individuals over 65 years of age fall each year; the incidence of falls in those over 75 years of age is 32-42%.[3] The annual incidence of falls in elderly diabetic individuals is 39%.[4] Diabetic complications lead to a multitude of impairments, which would constitute many recognized risk factors for falls.[5] There are several independent risk factors for falling and

these have been documented (in descending order of their evidence of clinical strength):a previous history of fall (or falls), stance and balance impairment, muscle weakness, visual impairment, multiple medications (of more than 4), CNS depressants, gait impairment and walking difficulty, depression, lightheadedness or orthostasis, functional limitations, age >80 years, female gender, urinary incontinence, global cognitive impairment, arthritis, diabetes, and pain syndromes. The risk of falling increases when more than one factor is present; the 1-year risk of falling doubles with each additional factor, starting from 8% with none, and reaching 78% when 4 risk factors are operative.[3]

METHODS

This cross-sectional observational study was conducted at the department of neurology of Shorsh military general teaching hospital and its outpatients' department, Iraq, from April 1st to September 30st, 2016. Patients were enrolled in the study if they were ≥65 years of age; were already diagnosed with type II diabetes and were receiving antidiabetic medications; and were demonstrating a history of fall. A fall was defined as an unintentional change in body position resulting in contact with the ground or lower level, not as a result of a major intrinsic event (e.g., stroke) or overwhelming hazard (e.g., car accident).

Patients were excluded if they had impaired fasting hyperglycemia only; received no medical treatment for diabetes (i.e., were on diet); had cognitive impairment or frank dementia; had blindness; and/or were immobile or wheelchair-bound.

All patients (n=100) underwent through history taking and physical examination by a neurologist and neurology trainees. All patients underwent a battery of blood tests (including serum TSH and B12), ECG, echocardiography, chest X-ray, monofilament testing, fundoscopy, visual acuity assessment, and brain CT scanning without contrast. The following investigations were done in selected patients, depending on their overall clinical picture: ophthalmological consultation (n=87); otorhinolaryngological consultation (n=14) with Nylan-Barany testing (n=11); 24-hour holter monitoring (n=4); electromyography and nerve conduction study (n=39); and joints plain X-rays (n=92).The collected data were organized, tabulated, and statistically analyzed using the statistical package for social sciences (SPSS) version 23.0 by an independent statistician. Authors calculated P-value, 95% confidence interval (95% CI), and odds ratio (OR). Significance levels were set at P-value of less than 0.05 in all cases.

RESULTS

There was an increased incidence of falls with increasing age; the mean age of the studied population wa71.2 ±3.6 years (p-value<0.001; 95% CI,63.7-91.6;OR 1.3) (Figure 1). All patients were diabetic.

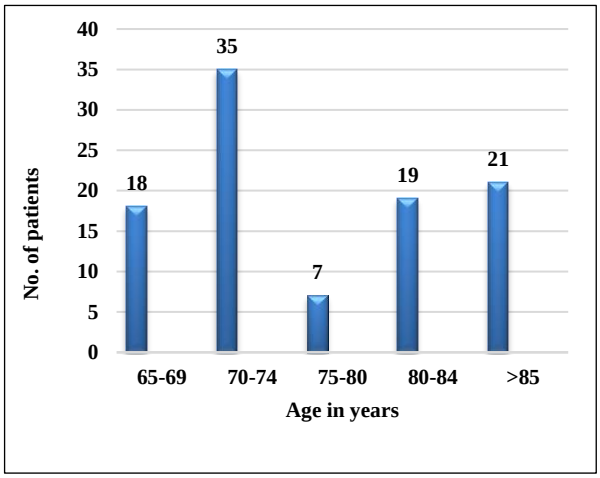

Figure 1: Age distribution of patients (n=100).

Females (n=57;57%) outnumbered males (n=43; 43%) and the female to male ratio was 1.3:1. The risk of fall was significantly associated with the female gender (p-value<0.001). (Figure 2), shows that a longer duration of diabetes was associated with more falls' frequency; the mean duration of diabetes mellitus in the studied population was 10.12±4.5 years (p-value<0.001); 95% CI, 0.78-27.3; OR 1.5).

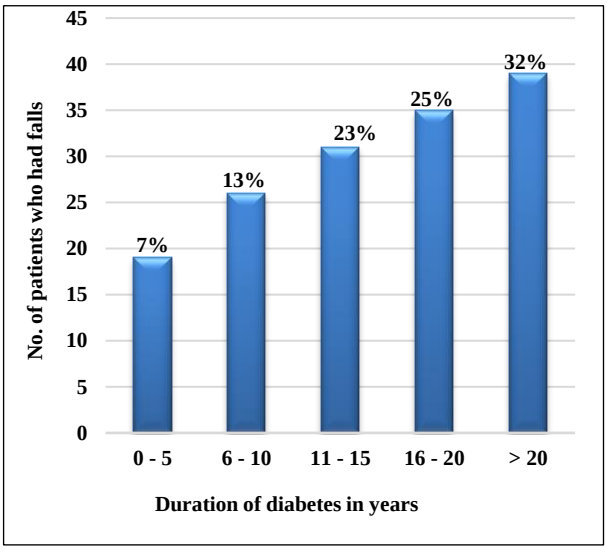

Figure 2: The percentage of patients who had developed a fall according their diabetes duration (number=100).

Out of 100 patients, 22 (22%) patients were receiving insulin and a sulfonylurea; 19 (19%) patients were taking a combination of insulin, a sulfonylurea, and metformin; and the remaining 59 (59%) patients were receiving some form of anti-diabetic therapy alone or in combination (Figure 3).

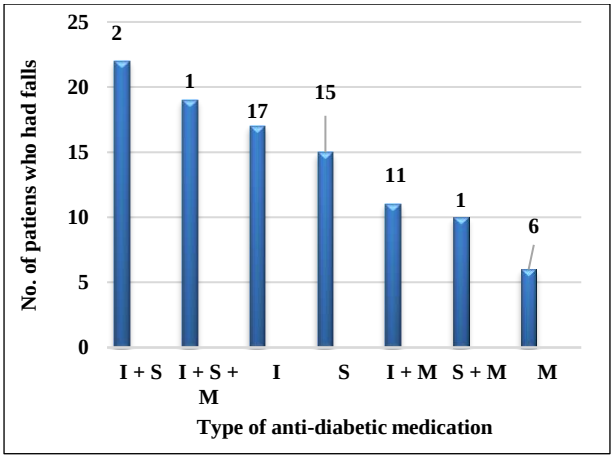

Figure 3. The number of patients with falls according to their anti-diabetic medication (I: insulin, S: sulfonylureas, M: metformin). The total number of patients is 100.

However, falls were statistically associated with insulin monotherapy (p-value<0.001) and/or oral sulfonylureas (p-value<0.01) rather than other medications (p-value=0.7). The combination of 3 anti-diabetic medications was highly associated with falls (p-value<0.0001). Seventy-nine percent of the patients demonstrated a glycosylated hemoglobin (HbA1c) level of ≥7.0, reflecting their uncontrolled hyperglycemia.

Twenty-one patients developed 2 falls; 37 patients had a single fall only; while the remaining 42 patients presented with 3 or more falls. Altogether, 46 patients had one fall during the past year while 54 developed 2 or more falls during the same period.

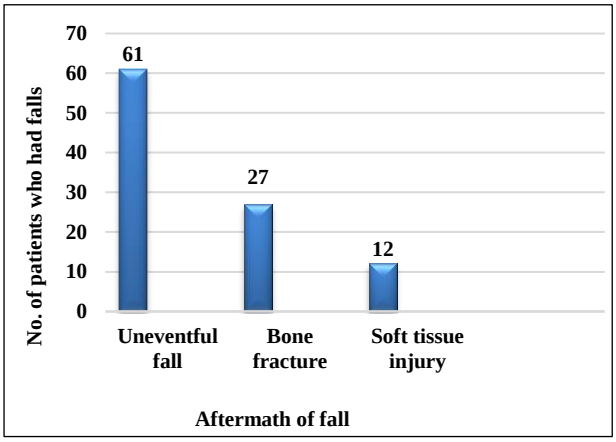

Figure 4. The number of patients with falls who had developed various types of injuries. The total number of patients is 100. The majority of the patients (61%) had an uneventful fall with no injuries. Soft tissue injury includes transient pain, skin bruises, skin scratch, and localized swelling. No intracranial hemorrhage of any type had occurred.

In more than half of the patients (n=61), the consequence of the fall was trivial and uneventful; only 12 patients developed direct head hit (but none of them developed any sort of intracranial hemorrhage) and 27 patients had bony fractures (Figure 4).

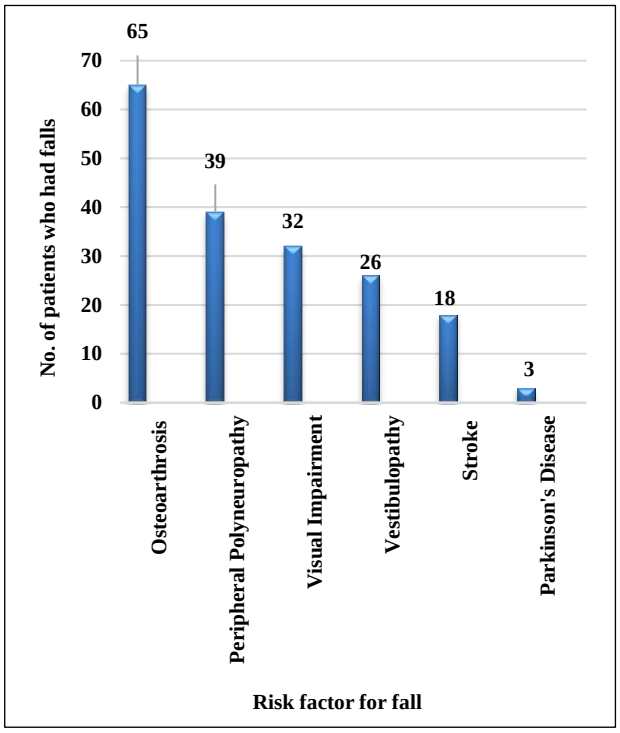

Figure 5: Distribution of the risk factors for falls. The total number of patients is 100. Visual impairment includes (in decreasing frequency) cataract, retinopathy, maculopathy, glaucoma, and occipital cortical stroke. Some patient demonstrated more than one disease (e.g., cataract and retinopathy).

(Figure 5) shows that osteoarthrosis, diabetic poly-neuropathy, visual impairment, and vestibulopathy were the commonest encountered risks factors. Approximately, half of the patients were living alone, were using some sort of walking aid, and were smokers. One-third of the patients were drinking alcohol.

DISCUSSION

Diabetes mellitus and falls are common in elderly people and can, therefore, be considered "geriatric giants". Diabetes in those population is linked to higher mortality rates, reduced functional capacities, and increased risk of hospitalization.[6] Each year, approximately one in three community-dwelling older adults aged 65 or over suffer one or more falls.[7] Older women with diabetes are 1.6 times more likely to have fallen in the previous year and twice as likely to have had injurious falls.[8] Diabetes mellitus has been identified as a risk factor for falls and fall-related injuries and fractures in a number of prospective studies.[9] Some researchers have found that the prevalence of such falls in people over the age of 65

years is higher in women.[10] Present study has suggested that the risk of falls in elderly diabetic patients, who have been receiving insulin therapy and/or an oral sulfonylurea is greater than those have been taking metformin alone. In addition, there was a significant relationship between the risk of falls and female gender, longer duration of diabetes, poor overall glycemic control, and poly-pharmacy (of 3 or more anti-diabetic medications); peripheral neuropathy, retinopathy, osteoarthrosis, and other risk factors for fall were all common among our patients. Our results have demonstrated a higher frequency of recurrent falls among females compared with males. This can be attributed to the preponderance of females who have had falls and who have been using walking aids. This observation is consistent with other international researches, which had found a higher prevalence of falls among women (who also had demonstrated more risk of injuries and fractures when they fall).[11] Present study had demonstrated an increased frequency of falls with an increased duration of diabetes (of more than 5 years); this might well have been explained by the development of diabetic micro-vascular and macro-vascular complications, a finding that has been found by Hausrdorff and coworkers.[7] Diabetic patients who have been taking insulin therapy have a higher risk of hypoglycemia, and therefore, falls than those who take oral antidiabetic medications only.[12] Kennedy RL et al, have concluded that insulin-treated diabetic patients were more likely to experience falls during a hypoglycemic episode; they also found that insulin-treated patients were more likely to sustain a fracture during that fall.[13] In patients who take oral hypoglycemic agents, the risk of hypoglycemia is higher among subjects who ingest oral sulfonylurea than those taking oral antidiabetic medications.[14] On the other hand, the use of oral insulin sensitizers was not associated with falls.[15] For instance, a combination of a thiazolidinedione (TZD) and metformin has not been shown to increase the risk of falls.[15] However, TZD was reported to increase the risk of fractures in diabetic patients by lowering bone formation and accelerated bone loss.[16] No risk has been attributed to falls when patients used glucagon-like peptide-1 analogs or dipeptidyl peptidase-4 inhibitors.[17] To minimize the risk of hypoglycemia (while maintaining a reasonable blood glucose control at the same time), several international medical organizations have suggested a target glycosylated hemoglobin levels.[18]

Tilling et al had reported an increased risk of falls in patients with poor glycemic control (HbA1c >7%).[19] Present study has found that 70% of patients had demonstrated high HbA1c. However, patients who have had an HbA1c of <6% and patients who were using insulin, were found to be at a higher risk of falls.[20] Therefore, achieving a tight glycemic control would be dangerous in elderly people.

In the third national health and nutrition examination survey, diabetes was a risk factor for falls and injurious falls in older women.[21] A study of African-American men and women aged ≥70 years had reported a higher risk of fall among individuals who have diabetes.[22] A high risk of critical injuries due to falls was reported among diabetic adults; however, another research, which was conducted in Florida, United States, has concluded that there is no association between diabetes and a high risk of fall-related injuries.[23,24] Soft tissue injury as an aftermath of the fall was encountered in 26% of our patients; hip, femur, and wrist fractures developed in 24% of the patients; and head injury occurred in 13.3%. These findings are consistent with some international figures.[25]

A study by Lord and coworkers had found that a common cause of somatosensory loss is peripheral neuropathy, often associated with diabetes.[25] This includes the sense of light touch and awareness of joint positions that are important for safe mobility and function. Reduced somatosensory sensation results in balance disturbance and increased risk of falling. Visual impairments (visual acuity, visual field, cataract, and macular degeneration) contribute to the risk of falls.[26,27] Impaired vision resulting from retinopathy and abnormal stance and gait caused by polyneuropathy can lead to falls.[28] Certain medical illnesses (cardiovascular diseases, chronic obstructive pulmonary disease, and chronic arthritis) are associated with an increased risk of falls. Dizziness (from cardiovascular diseases and hypertension) is a common finding in patients who had a history of fall. Cognitive dysfunction and frank dementia were strongly associated with increased risk of falls.[29]

Certain medications (other than anti-diabetics) confer an increased risk of falls. The use of polypharmacy has been found to increases the risk of falls in elderly people. Huang and colleagues found that diabetic patients (taking more than four medications) demonstrated a high risk of falls.[30] Approximately, 67% of our patients were taking 3 or medications. Leipzig and colleagues found an increased risk of falls in patients who use daily sedatives, diuretics, anti-arrhythmic medications, and psychotropic medications.[31] However, Lawlor and colleagues had found that co-morbidities might have explained the increased risk associated with medications ingestion.[32] The use of four or more medications is associated with a nine-fold increase in the risk of cognitive impairment and fear of falling.[33] With respect to social history, some researchers had found that elderly people who are residing at nursing homes fall more often than those who are living in the community; approximately 30-50% of people living in long-term care institutions fall each year, and 40% of them experienced recurrent falls.[34] Approximately 50% of elderly people in residential care facilities develop at least one fall each year while 40% of patients develop two and more falls per year.[35] Friedman analyzed the risk of falls in individuals 85 years of age and older and found that 20% of fall-related deaths occur in residential care settings.[36] Living alone can reflect a greater functional capacity, but injuries and outcomes can be worse, especially if the person cannot rise from the floor. Living alone has been shown to be a risk factor for

falls, although part of this effect appears to be related to certain types of housing older people may occupy. Our results are consistent with international researches; on the other hand, the use of a walking aid may protect against falls in those who have impaired mobility.[37] Cigarette smoking is a risk factor for falls among our patients. Cigarette smoking is associated with low bone mass and increased fall-related fractures.[38] Cigarette smoking is a strong risk factor for cardiovascular diseases and ischemic stroke, which are risk factors for falls. Alcohol impairs postural balance and cognitive judgment. Some chronic alcoholic individuals develop myopathy; therefore, there muscle power is reduced. Impairment in peripheral modalities of sensations and motor foot drop can occur with peripheral neuropathies; in addition, cerebellar damage can result in a reeling gait. Osteoporosis (combined with the negative effects of alcohol on gait and balance) results in higher age-adjusted rates of hip fractures among elderly people who drink alcohol.[39]

In summary, diabetes mellitus, and anti-diabetic medications confers an increased risk of falls and, hence, falls-related injuries and fractures in elderly people. Long duration diabetes and increased patients' age (which were the commonest risk factors in present study) are irreversible. Further analytic studies are required to further uncover the role of each risk factor. The presence of various and diverse etiologies behind falling in elderly diabetic patients call for multidisciplinary care to minimize, eliminate, or treat them if possible. However, present study has some limitations: the number of cases was relatively small; it is a single institutional study; the target population was composed of patients of Kurdish ethnicity only (who might well have different risk factors from Arab patients who constitute the majority of the Iraqi population and who were not involved in the study); and there was no "healthy" group as well as no locally or nationally published articles analyzing the same topic (so that we might compare the results with). Therefore, the findings might well have been different if the number of patients was larger, other hospital (and their patients were enrolled), and other ethnic groups were involved.

ACKNOWLEDGEMENTS

Authors would like to emergency room nursing staff.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Not required

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Cite this article as: Amin OSM, Amin AFA, Karim SK, Shwani SS, Thandoon R. Analysis of risk factors for falls in geriatric patients: a single institutional experience. Int J Adv Med 2019;6:605-10.