Falls in elderly patients with diabetes mellitus on insulin therapy and/or oral hypoglycemic drugs

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Introduction

Falls are a major cause of disability and a preventable cause of death in older people. Diabetes mellitus prevalence increases with age. A study by the Agency for Healthcare Research and Quality in America found that in 2010, diabetes-related Emergency Department visit rates were highest for patients aged 65 and older. The complications of diabetes may lead to an increased risk of falls in older diabetic patients.

Methods

This is a descriptive cross-sectional study to describe the prevalence of falls among diabetic elderly and to compare the prevalence between patients on insulin therapy and patients on oral hypoglycemic drugs in Sulaymaniyah, Iraqi Kurdistan for 1 year from 1st of July 2014 to 31st of June 2015.

Results

One hundred and fifty elderly diabetic patients with history of fall were included in this study, 88 (59%) were females and 62 (41%) were males. Their ages ranged between 65 and 90 years, mean age was 77.7 ± 7.11 years, and the mean duration of diabetes mellitus was 15.12 ± 7.36 years. The prevalence of falls increased significantly with increasing age, longer duration of diabetes, treatment with insulin therapy and sulfonylurea, patients with poor diabetic control, patients on polypharmacy, those requiring assistance with mobility, for those mobile with a stick and frame, those who had suffered peripheral neuropathy, osteoarthritis, retinopathy, cardiac problems, previous stroke, patients who live in institution, those living alone, smokers and alcoholics.

Conclusion

Poorly controlled diabetes, treatment with insulin therapy and to some extend sulfonylurea, and conditions associated with complications of diabetes are associated with an increased risk of falling in older people.

Keywords

elderly, diabetes mellitus, falls, insulin therapy, oral hypoglycemic drugs
by direct interview between the researcher and patients (person-to-person questionnaire) in the diabetic center and Emergency Department of Teaching Hospital, Shar Hospital in Sulaymaniyah, Iraqi Kurdistan region over the period from 1st of July 2014 to 31st of June 2015; 150 patients ≥65 years were collected. They were asked questions relating to the duration of diabetes, monitoring, their perception of occurrence of hypoglycemic episodes, symptoms and signs of postural hypotension, type of treatments they take for diabetes, history of falls and occurrence of falls within the past 12 months (How many times, if at all, have they had a fall in the last year?), also asked about consequence of falls whether non-traumatic, soft tissue injury and bruises, fractures or head injury, they were asked about their perception of visual impairment and peripheral neuropathy, past medical history and medications, polypharmacy, social history whether living in institution or live alone or with family, mobility whether they are walking independently or they use walking aids as sticks or frames, questions about smoking and alcohol drinking. A fall was defined as ‘An event, which results in a person coming to rest inadvertently on the ground or other lower level’ this was explained to the patient. Information was sought regarding contact with other medical specialties. We collected data about other risk factors for falls in diabetic elderly.

**Inclusion criteria**
1. Elderly-age ≥65 years old.
3. History of fall.

**Exclusion criteria**
1. Age <65 years.
3. Elderly diabetic without history of fall.
4. Mechanical falls (e.g., accidents).
5. Patients with dementia (documented after consultation with a neurologist), blindness and immobility and those who were unable to give informed consent were exclude from this study.

All patients were sent for the following investigations:
1. Random blood sugar.
2. HbA1c.
4. Monofilament score test as a screening test for peripheral neuropathy and electromyography and nerve conduction study for those with sever peripheral neuropathy.
5. Ophthalmologist consultation for suspected visual impairment, retinopathy, glaucoma and cataract.
6. ENT consultation for those with ear problems and vestibular disease.
7. ECG and Echo for cardiac problems.
8. Chest X-ray for COPD.
10. Brain CT-scan without contrast.

**Statistical analysis**
The collected data were organized, tabulated, and statistically analyzed using Statistical Package for Social Sciences (SPSS) version 21 by an independent statistician. Values were expressed as mean ± standard deviation (SD).

**Results**

There was an increased incidence of falls with increasing age, mean age of the study population was 77.7 ± 7.11 and 95% confidence interval (CI) was 63.7–91.6 as in Fig. 1.

Female gender was more than male in fall incidence (59% were females and 41% were males); the female to male ratio was 1.4:1 as shown in Fig. 2.

As shown in Fig. 3 with an increased duration of DM there were increased falls frequency, the mean duration of diabetes mellitus in the study population was 15.12 ± 7.36 and 95% CI was 0.692–29.54.

Out of 150 patients, 20.7% patients with falls on insulin + sulfonylurea, 18.6% were on insulin + sulfonylurea + biguanide and 8% patients on biguanide as shown in Fig. 4.

Percentage of falls were higher in patients with HbA1c ≥7 as shown in Fig. 5.

Figure 6 shows 57 patients with two episodes of falls, 49 patients with one episode and 44 patients with three or more episodes.

There were 57% with single fall and 43% with two episodes of falls in the last year as shown in Fig. 7.

Non-traumatic consequence of falls was more prevalent and head injury was the least prevalent as shown in Fig. 8.
As shown in Fig. 9, diabetic neuropathy, osteoarthritis and diabetic retinopathy were the most significant risk factors for falls in diabetic elderly.

Figure 10 shows 61% of patients with fall were on polypharmacy.

Regarding social history, 46.4% of patients live alone, 41% live with family and 12.6% live in institution as shown in Fig. 11.

As shown in Fig. 12 patients with walking aids had higher incidence (53.3%) of falls.

Out of 150 patients, 55% were smokers and 45% were non-smokers as shown in Fig. 13.

In this study, 11% of patients were mild-moderate drinkers and 8% with sever alcohol drinkers (alcoholic) as shown in Table 1.
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Monofilament test shows 83.3% were positive peripheral neuropathy test, as mild (28%), moderate (37.3%) and severe (18%) respectively as shown in Fig. 14 (For severe peripheral neuropathy we have done nerve conduction study and EMG).

Table 1. Percentage of falls in alcohol drinker diabetic elderly

<table>
<thead>
<tr>
<th>Alcohol drinkers</th>
<th>Mild-Moderate</th>
<th>Severe</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of patients (%)</td>
<td>11</td>
<td>8</td>
<td>19</td>
</tr>
</tbody>
</table>

Discussion

Diabetes mellitus and falls are common in the older population and can therefore be considered as ‘geriatric giants’. Diabetes in older adults is linked to higher mortality, reduced functional status, and increased risk of institutionalization. Each year, approximately one in three community-dwelling older adults aged 65 or above suffers one or more falls. Older women with diabetes are 1.6 times more likely to have fallen in 1999 in USA and twice as likely to have had injurious falls.

Diabetes mellitus has been identified as a risk factor for falls, and fall-related injuries and fractures in a number of prospective studies. A study in Spain found that the prevalence in people over age 65 is higher in women.

In this study, age was significantly related to falls, we identified an increased risk in the older subset of diabetic patients as 38 patients (25.3%) of the studied population above 85 compared with 22 patients (14.7%) of the studied population who are in age group (65–69 years) reported at least one incident of falling during the last year, these finding is supported by a study in Europe done in 1989 by Health Evidence Network.

We found in this study that there were an increased fall frequency with an increased duration of DM, 13% compared with 26% for duration (up to 5 years) and (above 20 years) respectively, which is due to diabetic micro- and macro-vascular complications, this is in agree with results found by Tilling et al. in a study done in 2006.

In this study, we found a significant relationship between falls and those on insulin therapy and sulfonylurea, 20.7% were on insulin with sulfonylurea, 16% on insulin, 13.3% on sulfonylurea and on the other hand, 8% on biguanide which is the most safe drug in diabetic elderly with normal renal function, in line with a number of studies done previously.

Tilling et al. reported increased risk of falls with poor glycemic control (HbA1c > 7%). This goes with this study, where 70% of participants had got uncontrolled HbA1c.

Recurrent falls, was significantly higher particularly among women who were treated with insulin. Polypharmacy also had a significant role in recurrent falls.

Out of participants in this study, 56% were complaining from peripheral neuropathy, 52.7% from osteoarthritis, 51.3% from diabetic retinopathy, 50.7% from hypertension, 45.3% from cardiac problems and 26% from vertigo, 24% from COPD, all are risk factors for fall in elderly diabetic, it is in line with previous studies: A study by Victorian Quality Council proves that a common cause of somatosensory loss is peripheral neuropathy, often associated with diabetes, 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 all contribute to risk of falls. We used mono filament test in this study as a screening test for peripheral neuropathy and we found 83.3% of patients with positive tests as 28%, 37.3%, 18% for mild, moderate, severe peripheral neuropathy respectively. For those with severe peripheral neuropathy we confirmed the diagnosis by doing nerve conduction study and EMG for them.
Regarding social history, previous studies show that older people who are living in 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. A study in Europe by WHO Regional Office for Europe shows: approximately 50% of older people in residential care facilities fall at least once a year; up to 40% fall more than once a year. The incidence of falls in institutional settings is 1.5 falls per bed per year. Our finding in this study is comparable with these studies except that regarding prevalence of falls in institutionalized participants who are under estimated in our study because of small numbers of diabetic elderly who attended the institution in Sulaymaniyah, Iraqi Kurdistan.

As we noted in our study smoking is a risk factor for falls among patients enrolled in the study, about 55% of them were smokers. This is supported by previous studies noted that smoking has been shown to be associated with low bone mass and risk of fall and fracture. Also smoking is a leading cause of heart disease and stroke which are risk factors for falls in elderly diabetic patients.

In this study, as noted out of 150 patients enrolled, 19% of them were alcohol drinkers and from this group 8% were alcohol (saw alcohol drinkers) which is parallel to previous study done in 1996 who stated that alcohol may cause a number of problems which predispose to falls and even modest social alcohol consumption may compound or exacerbate other risk factors for falls, intoxication causes acute instability. Older persons are particularly vulnerable to falls with alcohol consumption and predisposed to falls when reserve in postural support mechanisms is lost. Alcohol impairs balance and judgment, and the diuretic effect of alcohol may cause orthostasis. Some chronic alcoholics develop myopathy, and strength is often impaired. A decrease in sensory input and foot drop can occur with peripheral neuropathy, which along with cerebellar damage causes the classically described wide-based ataxic gait.

In summary the results of this study found that elderly diabetic patients especially females who are poorly controlled, treated with insulin therapy and to some extent sulfonylurea and who have complications of diabetes like peripheral neuropathy, arthritis, poor vision and diabetic patients with cardiovascular disease, polypharmacy and those using walking aids and living in institution are at high risk of falls. Avoiding the use of sulfonylureas and insulin unless it is necessary and using oral hypoglycemic agents that are least likely to cause hypoglycemia like metformin and/or dipeptidyl peptidase inhibitors unless contra indicated should be the first choice of therapy in diabetics aged 65 years or above in order to decrease the risk of falls and therefore the complications of these falls.

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Conflicts of Interest
None.

References

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