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Falls in older ambulatory care patients with cancer in Iran: Implications for clinical practice

Short running title: Falls in older outpatients with cancer

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Falls in older ambulatory care patients with cancer in Iran: Implications for clinical practice

Abstract

Rationale/aim: Falls can have severe consequences particularly for older patients with cancer undergoing ambulatory care. The aim of the study is to identify the predictors of falls in older patients receiving cancer ambulatory care and evaluate accuracy of the final multivariable model in detecting older patients with falls.

Method: A retrospective study was conducted on 300 older patients aged 60 years and above that were referred for ambulatory care in three oncology clinics based at hospitals in Tehran. Participants completed a questionnaire comprising demographic, history of falls, and cancer-related factors. Logistic regression was used to determine risk factors associated with falls.

Results: 35.3% of the older patients with cancer had experienced a fall in the six months following the start of their ambulatory care. The most important predictors of falls include the fourth stage of cancer (odds ratio (OR): 6.47, 95% confidence interval (CI): 3.20-13.08, P <0.001), fear of falling (OR: 5.64, 95%CI: 2.58-12.33, P<0.001), use of hearing (OR: 2.38, 95%CI: 1.07-5.29, P = 0.033) and visual aids (OR: 2.36, 95%CI: 1.12-5.01, P = 0.025), and the number of visits to the doctor (OR: 1.10, 95%CI: 1.01-1.21, P = 0.035).

Conclusions: The results indicate that a reduction in falls is possible by introducing strategies to improving care for older patients in advanced stage of cancer, eliminating the causes of fear of falling, examining and improving vision and hearing, and identifying and addressing the underlying causes of visits to the doctor.

KEYWORDS: accidental fall, risk factor, aged, cancer, ambulatory care

1 | INTRODUCTION

The increasing number of older people is a global phenomenon affecting all countries of the world particularly in developing countries such as Iran. According to a report of the Statistical Center of Iran, the proportion of older people is expected to increase from 10% in 2015 to over 30% by 2050.[1,2]

Falls are common among community-dwelling older people, with 13.2% to 28% of them experiencing a falling incident within a year.[3-5] Those older patients with cancer are more prone to falling than those without it with up to 52.1% reported falls over a six-month period.[2,6-10] Falls can cause dependence, loss of confidence in performing tasks, depression, immobility, hospitalization or admission to a nursing home, and imposed costs on the individual and society. Any delay in treatment because of injuries may have significant consequences for the disease trajectory among patients with cancer.[7,8,11] Unfortunately, patients do not usually report any falls to their oncologists and so assessment and identification of those at risk can help inform appropriate interventions to mitigate the impact of falls in those older patients with cancer that are receiving outpatient services.[6,11]

Previous studies have not found specific and consistent predictors for falling in older patients with cancer in the community.[7,9,10] Other studies did not discover any differences in incidences of falling among older community-dwelling cancer patients in terms of age, health functioning, and other sociodemographic, and health characteristics.[12] However, Sattar, Kenis, Haase, Burhenn, Stolz-Baskett and Milisen [8] and Sattar, Alibhai, Spoelstra, Fazelzad and Puts [13] showed that the only consistent predictors of falls among older patients in outpatient care were those experienced prior to treatment and they concluded that fall predictors in community-dwelling

older patients with cancer is not consistent.[7] Bird, Cheney and Williams [6] in a systematic literature review found pain, fatigue, and deconditioning may affect fall rates in the longer term in community-dwelling adults with a cancer diagnosis. In a study on survivors of breast and prostate cancer with a recognized history of falls, sensory impairment, unmarried, lower physical summary score of quality-of-life, urinary incontinence, older age at diagnosis, and shorter time post diagnosis were found to be significant predictors of falls in these survivors.[14]

However, due to the long-term nature of cancer treatment, the preference is to continue with it as ambulatory care in order to help reduce treatment costs, save time, and reduce complications from the disease and nosocomial infections, particularly in older people.[5] As older patients with cancer in ambulatory care are not generally reporting or being monitored for falls in a holistic way by health care workers when receiving medical services, they can be exposed to the hazardous consequences that falls can inflict.[11,15] Therefore, identification of risk factors for falling is important in order to develop programs for preventing and reducing such falls.[7,10,14]

The aim of the study is therefore to identify predictors of falls experienced by older patients with cancer receiving ambulatory care and evaluate accuracy of the final multivariable model in detecting older patients with falls.

2 | METHODS

2.1 | Study design and sample

This retrospective study was conducted on older patients referred to all oncology clinics at hospitals that have ambulatory oncology clinics and are affiliated to the Shahid Beheshti University of Medical Sciences in Tehran. Participants were selected using a convenience sampling method of older patients with cancer who had been referred to these clinics for ambulatory chemotherapy and radiation therapy during a three-month period from April-June

2019. Ambulatory care involved less than six hours of hospital stay based on patient admission forms for chemotherapy and radiation therapy, after which the patient was discharged and returned to his/her place of residence.

Inclusion criteria included 60 years of age and over, ability to speak Persian (national language of Iran), received already at least two sessions of chemotherapy or radiation therapy, and passed at least six months from cancer diagnosis by an oncologist. In order to determine sample size, by assuming a medium effect size and 20 predictors, and based on the formula,[16] a minimum of 300 participants is required. The researcher obtained a written informed consent from all participants prior to data collection and their participation in the study was voluntary and anonymous, with the possibility of withdrawing at any time or refusing to answer any questions without penalty. The researcher also informed participants that their medical records would be accessed for data collection purposes. Approval to conduct the study was confirmed by the Ethics Committee of Shahid Beheshti University of Medical Sciences under code IR.SBMU.PHNM.1396.977.

2.2 | Measurement

Data collection involved a questionnaire devised by a researcher and based on earlier studies. [15,17-20] The questionnaire contained 35 validated questions within three sections: 10 demographic questions (including age, gender, marital status, education, employment status, place of residence, and primary caregiver), 15 questions about falling and related factors, and ten cancer-related questions. Definition used for falls was events which result in a person coming to rest inadvertently on the ground or floor or other lower level. [20] Validity of the questionnaire was determined in terms of face and content, and reliability was determined as 0.89 by the test-retest method in a sample of n=20 older patients with cancer. Since the minimum reliability of 0.70 is sufficient,[21] the instrument was considered to be reliable. In order to collect the data, the

researcher visited the clinics during the working day and participants for the study were identified with the help of the head of the clinics and necessary explanations about the objectives of the study were then provided to each participant. Data were collected in-person from patients and their companions via the questionnaire prior to chemotherapy injections. Patients' medical records were also used to collect data about treatment and medications, including the type and stage of cancer, type of treatment, type of chemotherapy regimen, and the number of past sessions.

2.3 | Statistical analysis

The baseline characteristics of participants at the time of admission for ambulatory care were used to evaluate explanatory factors for falling events and bivariate and multivariable analyses were performed using a logistic regression model. Bivariate logistic regression helped to assess the association of each baseline variable with falls and those variables with a p-value ≤0.05 emerging from bivariate logistic regression were included as candidate variables for a multivariable logistic regression model to aid in identifying predictors of falls. Finally, a multivariable logistic regression was selected for which the effect of variable (odds ratio) was adjusted. A statistical significance considered to be at 5% level and 95% CI were calculated for each odds ratio. Receiver operating characteristic (ROC) curves were generated for the final multivariable logistic regression model. Area under the ROC curve (AUC) was calculated to evaluate accuracy of the final multivariable model in detecting patients with falls (AUC = 0.50, random chance; AUC = 0.70–0.90, moderate discrimination; and AUC = 1.00, perfect discrimination).[22] All statistical analyses were performed using SPSS 25 (IBM Corp., Armonk, NY).

3 | RESULTS

The mean age of participants in the study was 67.54 ± 6.78 years with 35.3% of participants having suffered a fall in the six months after starting ambulatory care. The characteristics of patients are shown in Table 1.

The mean of falls in the six-month period was 1.19 ± 2.76 times with a range of no falls to 10 and occurred during the night (43%), morning (36%), and evening (21%). Falls occurred on the stairs (23.5%), in bedrooms (19.8%), and toilets (14.2%) while 72.7% of participants, and 98% of the 106 study participants that had a fall, reported that they were afraid of experiencing a fall.

The highest fall rate occurred in patients with breast (24.29%) and prostate (19.81%) cancers, were in the third and fourth stage of the disease (57.66%), their chemotherapy regimen contained a combination of anti-metabolites and alkylating agents and more than six months had passed since their diagnosis of cancer.

A total of 21 variables were compared between those patients that had experienced falls and those that had not. Significant differences were observed in age, marital status, educational level, job status, personal home situation, smoking, other diseases, taking medication, sporting activities, number of physician visits, visual and hearing aids, mobility devices, fear of falling, and cancer stage (Table 1). No statistically significant differences were observed in body mass index, gender, surgical history, hospitalization history, caregiver, and cancer type. The significant variables were then put simultaneously into in a multivariable logistic regression model to look at their unique predictive strength.

Investigating the results of falling predictors using the logistic regression model showed that being in the fourth stage of cancer, having a greater fear of falling, having more use of hearing and visual aids, and having more visits to the physician were significant predictors for experiencing falls (Table 2).

In order to calculate a predictive score, the formula (score = 0.10 × visits number + 0.86 × (visual aid = yes) + 0.87 × (hearing aid = yes) + 1.87× (cancer stage = third and fourth stage) + 1.73× (fear of falling= yes) was used. The higher the score, the higher was the probability of falls. AUC for the final multivariable model was 0.84, indicating moderate accuracy in identifying patients with falls.

4 | DISCUSSION

According to the results of this study, the frequency of falls in older patients with cancer receiving ambulatory care was 35.3% during the last six months. The frequency of falls of older people during a year in countries, such as the USA,[3,14] Serbia,[4] and Iran,[5] was less than this rate. Therefore, the present study shows a significantly higher prevalence of falls among older patients with cancer and therefore makes it necessary to introduce better care and treatment programs in order to prevent and reduce the number of falls among those receiving ambulatory care. According to the results of the present study, the more advanced the stage of cancer, then the higher the probability of falling and therefore it follows that older patients in the third and fourth cancer stages are more than six times likely to fall than those in the first and second stages. Although Sattar, Spoelstra, Alibhai and Puts [23] showed that the circumstances of falls in community-dwelling older adults with cancer seem to be similar to those in the general geriatric population, the findings of Ward, Wong, Moore and Naeim [24] confirm the results of this study, that patients in the third and fourth cancer stages had the highest rate of falls. Patients in the advanced and late stages of cancer usually have extensive local invasion, lymph node involvement, and distant metastases.[25] This situation can not only lead to organ failure but also to patients receiving more aggressive treatment leading to higher toxicity and side effects that can further contribute to incidences of falling.[25] Some of the side effects of aggressive treatment

include nausea, vomiting, loss of appetite, fatigue, neutropenia, and neuropathy that can lead to an increase in the risk of falling.[26] In conclusion, therefore, the more advanced the cancer is, the higher the rate of falls that are likely to be experienced by older patients receiving ambulatory care.

Fear of falling was the second most significant predictor of falls and older patients with this fear were five times more likely to fall than those that were not afraid of doing so. Sattar, Alibhai, Spoelstra and Puts [11] reported that older cancer patients that had experienced a fall in the previous year had a heightened fear of doing so again. Gazibara, Kurtagic, Kisic-Tepavcevic, Nurkovic, Kovacevic, Gazibara and Pekmezovic [4] showed that fear of falling in the general older population increased the probability of doing so more than four times. The fear of falling among older people can be due to physical changes, including musculoskeletal weakness, for example, plus living with chronic diseases like cancer that require long-term treatment, and medications that can have severe side effects such as dizziness, drowsiness, fluctuations in blood pressure and blood sugar, fatigue, loss of appetite, and general weakness that can eventually lead to changes in balance.[27] Consequently, a fear of falling due to anxiety and decreased self-esteem, could be considered as another significant risk factor in older patients receiving ambulatory cancer care.[28] The fear of falling can itself become a debilitating condition for older people and be associated with negative consequences such as a reduction in daily activities, reduced physical activities, deconditioning, loss of muscle mass and gait issues, a downward spiral of personal functions, increased risk of further falls, perceived lower physical health status, and lower quality of life.[29] Such a fear may not be due to injury and subsequent physical disability, but rather to an older person's lack of belief in their ability to maintain balance.[5,28]

The use of hearing aids is another predictor of falls in older patients receiving ambulatory cancer care. It increases probability of falls more than double risk of falling in compare with older patients without need to using of hearing aids. Tiase, Tang, Vawdrey, Raso, Adelman, Yu, Applebaum and Lalwani [30] and Jiam, Li and Agrawal [31] showed that older adults and patients in the inpatient settings with hearing loss and no hearing aids had significantly more than double risk of falls in compare to individual with normal hearing. Hearing aids improve static balance function by reducing the velocity that lead to increase postural stability and reduced risk of falls among older adults with hearing loss.[32,33] Therefore, we should support older patients to use their hearing aids in order to reduce the risk of falls during ambulatory care.

Another predictor of falls in older patients receiving ambulatory cancer care is visual disorder and the use of visual aids. The rate of falls was found to be two times higher in people using visual aids, including lenses or glasses, than in those patients with normal vision. Ehrlich, Hassan and Stagg [3] showed that visual impairment or the use of visual aids can increase the probability of falls in older people. This situation could arise due to poor eyesight, inappropriate use of or improper and inefficient visual aids such as bifocals or multifocal glasses, that can lead to an increased risk of falling.[15,34] The higher the degree of visual disorder in older patients, therefore, and their greater reliance on visual aids, then the more probable falling will be.

The results revealed that visits to the doctor can increase the risk of falling by 10% for each visit. The number of visits is likely a proxy for disease severity /symptom burden experienced by patients. In recent study, great majority of patients were in advanced stage of cancer and a noticeable number of them have at least one chronic disease in addition to cancer. These combined with the impact of cancer treatment and its side effects that can increase fall risk.[8,25] Also, it would be

advisable to decrease the frequency of unnecessary referrals to the doctor's office or outpatient clinics as much as possible for patients to receive treatment via homecare.

Lastly, AUC in the final multivariable regression model was moderate in detecting older patients with falls who receiving ambulatory cancer care. We did not aim to develop a prediction model for falls in older ambulatory care patients with cancer. However, the current findings provide the foundation for future research in developing and evaluating risk prediction models that are specific to each care system and cancer type and incorporate health assessment data and other risk factors of for falls. Prediction models with validated sensitivity, specificity, likelihood ratios, and other discriminative indices can guide fall prevention strategies in older ambulatory care patients with cancer.

4.1 | Limitations

There are limitations that may have affected the results of our study. Firstly, self-reported information limits interpretation of the results because of problems such as precise recall of events. Secondly, the study population was selected from three clinics in Tehran and the total sample size was limited. Therefore, it is suggested that further studies be conducted with a larger sample size.

4.2 | Implications for clinical practice

The results indicate that there is a high rate of falls in older patients receiving ambulatory cancer care. Therefore, attention to and prevention of falls in this cohort are required. Awareness needs to be increased for medical staff about older patients about falls, developing and supporting falls prevention plans, particularly those that are in the later stages of the disease. They can identify older people with fear of falling, investigating and identifying those causes, and design programs such as participate in peer networks and social activities in order to prevent and decrease of fear

of falling at home, hospital, and community. It can also be achieved by regular monitoring, follow up of the correction of a patient's vision and hearing impairments, rearrangement and increasing environment safety of living places, and encourage them in order to use of the suitable aid devices at home and hospitals. Also, identifying and addressing the underlying causes of visits to the doctor and using telenursing or telemedicine at the patient's place of residence as far as possible in order to decrease unnecessary commute between home and clinics will be helpful to prevent of falls.

5 | CONCLUSION

This study showed that a significant proportion of older patients receiving ambulatory cancer care experience falls. The results indicate that with increasing attention to the older patients at the advanced the stage of cancer, decreasing fear of falling, and correction of the impairments of vision and hearing, falls of older patients will decreases. In addition to, identifying and addressing the reasons of visits to the doctor will help to decrease falls in older patients with cancer undergoing ambulatory care.

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CONFLICT OF INTEREST STATEMENT

The authors declare that they have no conflict of interest.

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TABLE 1 Participants characteristics at baseline and odds ratios for falls from univariable logistic regression.

Variable		Falls		OR (95% CI)	p-value
		Yes (n=106)	No (n = 194)		
Age (Year)†		67.54 (±6.78)	65.23 (±5.08)	1.08 (1.04-1.13)	<0.001
Body mass index	Kg/m2	21.16(±3.58)	21.55(±3.56)	0.97 (0.91-1.04)	0.365
Gender	Female	45 (42.5)	90 (46.4)		Ref.
	Male	61 (57.5)	104 (53.6)	0.85 (0.52-1.37)	0.512
Marital status	Married	52 (49.1)	136 (70.1)		Ref.
	Single & widowed	54 (50.9)	58 (29.9)	2.44 (1.49-3.97)	<0.001
Educational Level	Literate	52 (49.1)	134 (69.1)		Ref.
	Illiterate	54 (50.9)	60 (30.9)	2.32 (1.42-3.77)	0.001
Job status	Employed & retired	32 (30.2)	80 (41.2)		Ref.
	Unemployed	31 (29.2)	37 (19.1)	7.95 (1.71-36.87)	0.008
	Housewife	43 (40.6)	77 (39.7)	5.30 (1.17-23.87)	0.030
Personal home	No	46 (43.4)	51 (26.3)		Ref.
	Yes	60 (56.6)	143 (73.7)	0.45 (0.28-0.76)	0.003
Smoking	No	73 (68.9)	160 (82.5)		Ref.
	Yes	33 (31.1)	34 (17.5)	2.12 (1.22-3.69)	0.007
Other diseases	No	51 (48.1)	126 (64.9)		Ref.
	Yes	55 (51.9)	68 (35.1)	1.98 (1.23-3.23)	0.005
Taking medication	No	42 (39.6)	109 (56.2)		Ref.
	Yes	64 (60.4)	85 (43.8)	1.95 (1.2-3.16)	0.006
Sports activities	No	68 (64.2)	89 (45.9)		Ref.
	Yes	38 (35.8)	105 (54.1)	0.47 (0.29-0.77)	0.003
Surgical history	No	76 (71.7)	133 (68.6)		Ref.
	Yes	30 (28.3)	61 (31.4)	0.86 (0.51-1.44)	0.572
Hospitalization history	No	20 (18.9)	46 (23.7)		Ref.
	Yes	86 (81.1)	148 (76.3)	1.33 (0.74-2.4)	0.334
Visit number		6.58 (±3.37)	2.23(±1.08)	1.11 (1.03-1.19)	0.004
Caregiver	No	14 (13.2)	25 (12.9)	1.02 (0.5102.07)	0.937
	Yes	92 (86.8)	169 (87.1)		Ref.
Visual aid	No	38 (35.8)	134 (69..1)		Ref.
	Yes	68 (64.2)	60 (30.9)	3.99 (2.42-6.59)	<0.001
Hearing aid	No	55 (51.9)	158 (81.4)		Ref.
	Yes	51 (48.1)	36 (18.6)	4.07 (2.41-6.88)	<0.001

Mobility devices	No	39 (36.8)	128 (66)		Ref.
	Yes	67 (63.2)	66 (34)	3.33 (2.03-5.46)	<0.001
Fear of falling	No	12 (11.3)	80 (41.2)		Ref.
	Yes	94 (88.7)	114 (58.8)	5.50 (2.83-10.69)	<0.001
	Digestive system	33 (31.1)	66 (34)	0.58 (0.27-1.22)	0.149
	Prostate	14 (13.2)	38 (19.6)	0.43 (0.18-1.02)	0.054
	Breast & reproductive system	40 (37.7)	68 (35.1)	0.68 (0.33-1.41)	0.301
Cancer type	Lymphoma & sarcoma	19 (17.9)	22 (11.3)		Ref.
Cancer stage	Stage 1 & 2	19 (17.9)	108 (55.7)		Ref.
	Stage 3 & 4	87 (82.1)	86 (44.3)	5.75 (3.25-10.18)	<0.001
Type of treatment	Radiotherapy	13 (12.3)	45 (23.2)		Ref.
	Chemotherapy	93 (87.7)	149 (76.8)	2.16 (1.11-4.22)	0.024

Abbreviations: OR, odds ratios; CI, confidence interval; Ref., Reference group.

Notes: N (%) for categorical variables and means (SD) for quantitative (†).

TABLE 2 Regression model for predicting falls in older patients with cancer

Variable	Estimate (β)	SE	Odds Ratios (95% CI)	P-value
Visits number	0.09	0.05	1.10 (1.01 - 1.21)	0.035
Visual aid [a]	0.86	0.38	2.36 (1.12 – 5.01)	0.025
Hearing aid [a]	0.87	0.41	2.38 (1.07-5.29)	0.033
Fear of falling [a]	1.73	0.40	5.64 (2.58 – 12.33)	<0.001
Cancer stage [b]	1.87	0.36	6.47 (3.20 – 13.08)	<0.001

Abbreviations: SE, standard error

Reference group: [a] No, [b] Cancer stage 1 and 2