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Geriatric assessment as an aide to understanding falls in older adults with cancer

Grant R. Williams,
UNC Lineberger Comprehensive Cancer Center, 450 West Drive, Chapel Hill, NC 27514, USA

Allison M. Deal,
UNC Lineberger Comprehensive Cancer Center, 450 West Drive, Chapel Hill, NC 27514, USA; University of North Carolina at Chapel Hill, Physician's Office Building 170 Manning Drive, 3rd Floor, Campus Box 7305, Chapel Hill, NC 27599-7305, USA

Kirsten A. Nyrop,
UNC Lineberger Comprehensive Cancer Center, 450 West Drive, Chapel Hill, NC 27514, USA; University of North Carolina at Chapel Hill, Physician's Office Building 170 Manning Drive, 3rd Floor, Campus Box 7305, Chapel Hill, NC 27599-7305, USA

Mackenzi Pergolotti,
Department of Health Policy and Management, UNC Gillings School of Global Public Health, 135 Dauer Dr, Chapel Hill, NC 27599, USA; University of North Carolina at Chapel Hill, Physician's Office Building 170 Manning Drive, 3rd Floor, Campus Box 7305, Chapel Hill, NC 27599-7305, USA

Emily J. Guerard,
UNC Lineberger Comprehensive Cancer Center, 450 West Drive, Chapel Hill, NC 27514, USA; University of North Carolina at Chapel Hill, Physician's Office Building 170 Manning Drive, 3rd Floor, Campus Box 7305, Chapel Hill, NC 27599-7305, USA

Trevor A. Jolly, and
UNC Lineberger Comprehensive Cancer Center, 450 West Drive, Chapel Hill, NC 27514, USA; University of North Carolina at Chapel Hill, Physician's Office Building 170 Manning Drive, 3rd Floor, Campus Box 7305, Chapel Hill, NC 27599-7305, USA

Hyman B. Muss
UNC Lineberger Comprehensive Cancer Center, 450 West Drive, Chapel Hill, NC 27514, USA; University of North Carolina at Chapel Hill, Physician's Office Building 170 Manning Drive, 3rd Floor, Campus Box 7305, Chapel Hill, NC 27599-7305, USA

Abstract

G. R. Williams grwillia@unch.unc.edu.

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Author's contributions All authors were substantially involved in the study concept, design, acquisition of data, data analysis and interpretation, and preparation of manuscript. All authors meet the criteria for authorship stated in the Uniform Requirements for Manuscripts Submitted to Biomedical Journals, and final approval has been obtained from all authors. All individuals that have contributed significantly to the work have been listed.

Purpose—In older adults, falls are a common cause of functional decline, institutionalization, and reduced quality of life. This study (1) investigates the prevalence of falls in a large sample of community-dwelling older adults with a cancer diagnosis and (2) evaluates the association of falls with domains of comprehensive geriatric assessment (CGA) that pertain to falls risk.

Methods—Patients completed a CGA that includes a self-reported measure of number of falls in the past 6 months. Summary statistics are used to describe prevalence of falls and associations with hypothesized risk factors using Fisher's exact tests and multivariable logistic regression.

Results—A total of 1172 patients were enrolled, mean age 73 (65–99), 74 % female, and 89 % Caucasian. Two hundred fifty-six (22 %) reported one or more falls within the last 6 months. Patients with at least one instrumental activities of daily living (IADL) or physical function deficit had more falls as compared those with no deficits identified ($p \leq 0.001$). The number of daily medications, comorbidities, Timed Up and Go score >14 s, and poor vision were also associated with increased falls ($p \leq 0.001$). Reduced physical function, poor vision, and low performance status had the highest adjusted odds ratio (3.6, 3.4, and 3.0, respectively) for falls.

Conclusions—There is a high prevalence of falls in community-dwelling older patients with a cancer diagnosis. Falls are significantly associated with several measures of geriatric assessment including IADL, physical function, comorbidities, medications, and vision. Timely identification and management of risk factors for falls are important considerations in the care of older cancer patients.

Keywords

Falls; Cancer; Geriatric oncology; Geriatric assessment

Introduction

Every year, nearly one third of community-dwelling adults age 65 or older experience a fall [1, 2]. Falls are the leading cause of both fatal and non-fatal injuries in older persons [3] and often result in functional declines, institutionalization, and decreased quality of life [4, 5]. Even non-injurious falls place adults at high risk for future falls and potentially increase fear of falling that can lead to restriction of activity and further declines in health [6]. The reasons for falls among the elderly are multifaceted and often the result of a combination of intrinsic (e.g., pre-existing disease or chronic condition, polypharmacy, muscle weakness, functional limitations, and vision impairment) and extrinsic risk factors (e.g., hazards in the home and poor footwear) [7].

Falls among older adults with a cancer diagnosis are of added concern because cancer itself and certain cancer treatments can compromise bone health and physical function which, in turn, increase the risk for falls and fractures [8]. Several studies of community-dwelling older adults have found significant differences in fall rates between elderly persons with and without a cancer diagnosis, with one study reporting 26.4 vs 21.9 % (odds ratio, OR=1.17, $p \leq 0.001$) [9] and another reporting 33 vs 26 % (OR=1.16, $p=0.03$) [10]. In a large epidemiologic study of post-menopausal women living in the community, the risk for falls increased significantly for women with a breast cancer diagnosis (hazard ratio, HR=1.15) or other cancer diagnosis (HR=1.27, $p \leq 0.001$) [11].

Increased fall risk has also been associated with certain cancer treatments [12]. For example, in a study of breast cancer patients with chemotherapy-induced amenorrhea at 1 year post-chemotherapy, 76 % of the breast cancer patients reported falls compared to 46 % of women without a cancer diagnosis [13]. Further, in a study of prostate cancer patients undergoing androgen derivation therapy (ADT), the authors concluded that the treatment itself contributed to impairments in activities of daily living (ADLs) (24 % of patients) and instrumental ADLs (IADLs) (42 %) which, in turn, increased the risk for falls (22 %) [14].

These findings suggest the importance of assessing fall risk during clinic visits with the oncologist and identifying fall risks that might be remediable through timely interventions [15]. In this manuscript, we report on the use of a validated brief comprehensive geriatric assessment (CGA) to estimate (1) the prevalence of falls in a large sample of community-dwelling older persons with a cancer diagnosis and (2) the prevalence of impairments or deficiencies in domains of the CGA that pertain to fall risks. The CGA used in this study is largely patient-reported and specifically designed for busy oncology clinics (see Materials and Methods for further details) [16–19].

Materials and methods

Participants

The sample for this study is comprised of cancer patients who consented to participate in “Carolina Senior: Registry for Older Patients” (protocol approved by the Institutional Review Board of the University of North Carolina, NCT01137825). The registry is used to collect CGA data on patients 65 years or older and recruits through oncology clinics associated with a large academic medical center and several community sites across North Carolina. The CGA has been used extensively in oncology studies and is comprised of validated and reliable measures [16–18]. Informed consent is obtained from all patients prior to participation.

Measures and data collection

The study reported here is limited to CGA measures that are known risk factors for falls in older persons living in the community [15]. The first section of the CGA is completed by a health-care professional and includes the following measures: Timed Up and Go (TUG) test [20], Karnofsky Performance Status (KPS) [21], Blessed Orientation Memory Concentration (BOMC) test [22], and Body Mass Index (BMI) [23]. The second section is patient-reported and includes the following measures: instrumental activities of daily living (IADL) [24], physical function [25], patient-reported KPS [26], vision [27], hearing [28], medications [29], comorbidities [30], nutritional status [31], and mental health [32]. This section also includes a specific question that asks “how many falls have you had in the past 6 months?”. All of these measures were dichotomized at cut points validated in the literature (see Table 1 for CGA measures and scoring used in this study). In addition, study participant characteristics were collected with regard to age, gender, race, educational level, marital status, cancer type, treatment phase when the CGA was completed (pre-, during, or post-treatment), and location where the CGA was completed (academic vs community clinic).

Statistical analysis

Descriptive statistics were calculated to describe baseline characteristics of the sample. Patients were dichotomized according to the presence of falls in the last 6 months (none, 1, or more), and patient characteristics of the two groups were evaluated using Fisher's exact tests. Descriptive statistics were also used to characterize the subset reporting >1 falls for each of the CGA domains using cut points listed in Table 1. Multivariable logistic regression models were used to evaluate the association of individual CGA domains with falls (odds ratios, OR) while adjusting for age, race, gender, education, and treatment phase. Similar multivariable logistic regression models were used to estimate ORs for falls for individual comorbidities. SAS statistical software version 9.3 (SAS Institute Inc., Cary, NC) was used for all analyses.

Results

A total of 1172 older adults with a cancer diagnosis were enrolled in the Carolina Senior Registry between October 2009 and June 2014 and comprise the sample for this study. Characteristics of the sample are shown in Table 2. Sixty-four percent (n=750) were recruited through an academic cancer center and 36 % (n=420) through community clinics. All registry participants were community-dwelling. The majority of patients had breast cancer (n=593, 55 %) or hematologic malignancies (n=162, 14 %). The CGAs were performed at various time points of cancer treatment, with 25 % performed prior to treatment, 40 % during treatment, and 35 % after treatment.

In our sample, 22 % (n=256) reported a fall within the last 6 months, 12 % (n=140) reported one fall, 6 % (n=66) reported two falls, 1 % (n=16) reported three falls, and 3 % (n=34) reported four or more falls. Table 2 compares patient characteristics between those who did and did not report any falls in the past 6 months. Between the two groups, those with at least one fall were slightly older (p=0.03) and more likely to have been seen at an academic institution (p=0.02). There were no significant differences between the two groups with regard to gender, race, education, marital status, cancer type, or phase of treatment.

Figure 1 provides a comparison of CGA domain results with the proportion of patients that reported one or more falls. Of patients with one or more IADL deficits, 33 % reported a fall within the last 6 months, whereas only 16 % of patients with no IADL deficits reported a fall. Thirty percent of patients with a prolonged TUG score reported a recent fall, while only 19 % with a normal TUG score had fallen. Higher numbers of medications and comorbidities, poor vision and hearing, and KPS scores of ≤80 as rated by either the patient or provider were also associated with an increased proportion of reported falls.

Results from multivariable logistic regression analyses for falls/no falls and each CGA domain are presented in Table 3 as OR with 95 % confidence intervals (CI). Each OR is from a separate model including the covariate of interest controlling for age, race, gender, education, and treatment phase. Impairments in physical function, vision, and provider-rated KPS had the highest ORs (3.6, 3.4, and 3.0, respectively). IADLs, TUG, medications, comorbidities, mental health (MHI-5), and location where the CGA was conducted were also significantly associated with reported falls.

Similar analyses were conducted for individual comorbidities, as presented in Table 4. Of the conditions included, only the presence of arthritis, circulation problems, stroke, and depression were significantly associated. There was no association with hypertension, diabetes, or heart disease. For each additional comorbidity, the odds for reported falls increased by 20 %.

Discussion

A brief CGA that has been tested in busy oncology clinics is able to detect falls and functional deficits that may be predictive of future falls. In this large and diverse study population that includes patients from both academic and community settings, we confirm the high prevalence of falls found in previous studies of community-based oncology patients. We noted no significant differences in fall rates by cancer type—breast, hematological malignancies, lung, or other cancers. We also noted no significant differences in fall rates by treatment phase—pre-, during, or post-treatment.

Using validated cut points for defining clinically important impairments or deficits, our analysis identified several domains of the CGA that were significantly associated with falls in our sample, including IADL dependence, reduced physical function, prolonged TUG, high numbers of comorbidities and medications, impaired hearing, impaired vision, and poor mental health. Another study of cancer patients has similarly shown that the number of deficits in IADLs is strongly associated with increased falls [33]. Many of these factors have been shown to be risk factors for falls in non-cancer patients, specifically limitations in physical function and vision impairments, that are a common theme in fall-related research [2, 7]. In our study, the strong association between KPS scores and falls suggests that this measure alone could be a useful tool in identifying patients at risk for falls. An increased prevalence of falls with increasing age was not significant, except in patients over the age of 85, and although this may be in part related to a selection bias of healthier older adults, age alone does not appear to be a useful predictor of falls. The higher rates of self-reported falls among patients recruited in an academic clinic setting may suggest that patients seen at referral centers may have more CGA impairments. Similar findings have been noted in a comparison of community and academic settings, with slightly higher rates of medication use and prolonged Time Up and Go scores in academic as compared to community settings [19].

Several of the CGA domains associated with falls are potentially modifiable through timely identification and appropriate referral. For example, the most effective fall interventions include a multifaceted approach to fall management [34], beginning with a primary evaluation of fall risk in a clinic setting [35]. The primary evaluation should include a review of medications, measurement of orthostatic blood pressure, vision assessment, gait/balance assessment, and cognitive evaluation with referral to supportive services when a patient is identified at risk of falling [36]. Physical therapy (PT) and occupational therapy (OT) are examples of supportive services that are specifically focused on decreasing risk of falls, improving functional status, and increasing independence in daily activities [37–39]. Specialists in PT can identify and treat gait disturbance, muscle deconditioning, and muscle imbalance. They can also provide older adults with appropriate, individualized exercise

programs as well as durable medical equipment as needed to improve balance and increase strength [38]. OT specialists, in turn, focus on enhancing the patient's safe participation in basic and instrumental activities (e.g., bathing, toileting, grooming, and laundry) and use activities as interventions to improve quality of life and increase independence in daily routines, activities, and social roles. OTs are also trained in the modification and adaptation of the home and environment, which are important to decreasing risk of falling [34, 40, 35].

In our study, patients with specific comorbidities such as arthritis, circulation problems in their arms or legs, depression, or stroke were more likely to fall. While we did not find an association between falls and hypertension, diabetes, or heart disease, we did find that increased numbers of comorbidities were significantly associated with falls. Some of these associations could be directly related to impairments in physical function as often seen in patients with arthritis [41] or stroke [42], regardless of cancer comorbidity. Depression has also been independently associated as a predictor of falls in prior oncologic studies [43]. Timely referrals to address arthritis and depression may be effective interventions, as well as a review of medications for polypharmacy and medication interactions that pose risks for falls [44, 45].

This study has some limitations. As a retrospective cross-sectional study, it is beyond the scope of this study to determine causal relationships between reported falls and CGA domains. We report associations that offer insights but make no claim of identifying predictors of falls among older cancer patients. Further, the registry that provided the sample for this study is a non-randomized sampling of patients from oncology clinics, which poses a risk of selection bias, such as "healthier" patients being more willing than others to participate in the registry. Finally, a large proportion of patients in the sample were breast cancer patients who are often healthier than other cancer patients; however, we note again that we found no significant differences in fall rates by cancer type.

This study contributes to the literature documenting the prevalence of falls in older adults with a cancer diagnosis. We show that self-reported falls are associated with many potentially modifiable factors that are readily identifiable through a brief CGA. The increasing use of CGA in older cancer patients could potentially identify patients who may benefit from the many interventions that are proven to reduce fall risk and should be incorporated in routine oncologic practice. More prospective studies are needed to evaluate the value of CGA in identifying risk for future falls and test fall interventions in older patients with a cancer diagnosis.

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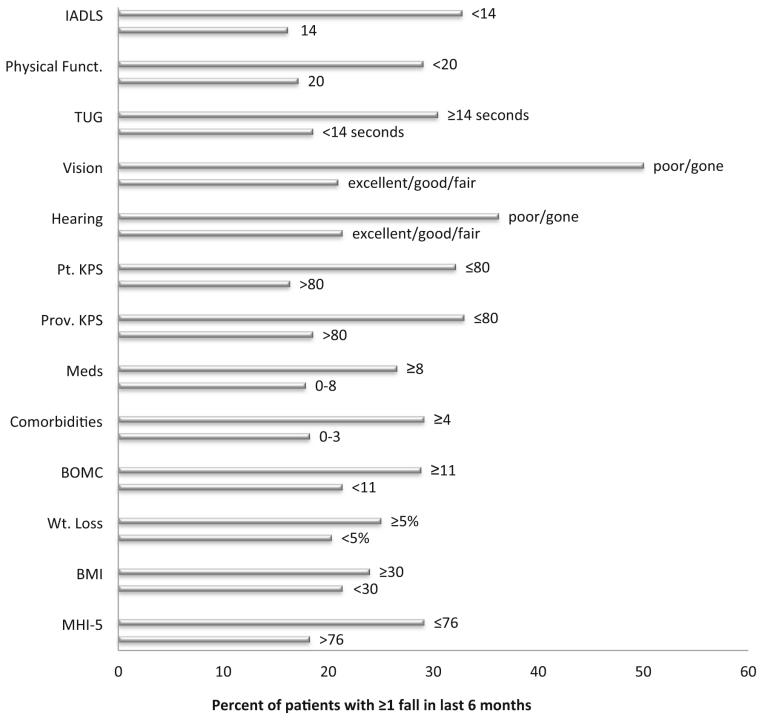

Fig. 1.

Falls and CGA Measures (*N*=1172). Shows clinically important cut points in domains of CGA and their relationship to proportions of falls. For example, of the patients reporting poor or no vision, 50 % reported one or more falls in the last 6 months, while of the patients reporting excellent, good, or fair vision, only 21 % reported a fall. *IADLs* instrumental activities of daily living, *Physical Funct* physical function, *TUG* Timed Up and Go, *Pt. KPS* Patient Karnofsky Performance Status, *Prov. KPS* Provider Karnofsky Performance Status, *BOMC* Blessed Orientation Memory Concentration test, *Wt Loss* weight loss, *BMI* Body Mass Index, *MHI-5* Mental Health Index-5

Table 1

Comprehensive geriatric assessment domains, measures, and scoring

Domain	Measure	Score Range	Dichotomized
Function	Instrumental activities of daily living (IADL) [24]	0–14 14=can do without help	≤14, 14
	Physical function [25]	0–20 20=not at all limited	<20, 20
	Timed Up and Go (TUG) [20]	Timed (seconds) Higher score→lower functioning	<14 s, ≥14 s or unable to complete
	Vision [27]	Excellent, good, fair, poor, totally blind	Excellent/good/fair vs. poor/gone
	Hearing [28]	Excellent, good, fair, poor, totally deaf	Excellent/good/fair vs. poor/gone
	Patient and Provider Karnofsky Performance Status (KPS) [26, 21]	0–100 Higher score→better functioning	≥80, <80
Comorbidity	No. of medications [29]		≥9, <9
	No. of comorbidities [30]		≥4, <4
Cognition	Blessed Orientation Memory Concentration test (BOMC) [22]	0–28 Higher score→lower cognition	<11, ≥11
Nutrition	Unintentional weight loss in past 6 months [31]	More unintentional weight loss→poorer nutrition	≥5 %, <5 %
Body composition	Body Mass Index (BMI) [23]	No upper or lower limit	≥30, <30
Psychological	Mental Health Index (MHI-5) [32]	0–100 Higher score→better mental health	≤76, >76
Falls	Falls in the past 6 months		≤1 fall, >2 falls

Table 2

Patient characteristics

	All	No falls	≥1 Falls	*p* value
Total patients	1172	916 (78 %)	256 (22 %)[a]	
Age, years				
Mean age	73	73	74	0.06
65–69	416 (36 %)	324 (35 %)	92 (36 %)	0.03
70–74	333 (28 %)	273 (30 %)	60 (23 %)	
75–80	211 (18 %)	166 (18 %)	45 (18 %)	
80–85	129 (11 %)	99 (11 %)	30 (12 %)	
>85	83 (7 %)	54 (6 %)	29 (11 %)	
Location				
Academic clinic	750 (64 %)	570 (62 %)	180 (71 %)	0.02
Community clinic	420 (36 %)	345 (38 %)	75 (29 %)	
Sex				
Male	309 (26 %)	239 (77 %)	70 (23 %)	0.69
Female	861 (74 %)	676 (79 %)	185 (22 %)	
Race				
White	1036 (89 %)	813 (79 %)	223 (22)	0.38
Black	120 (10 %)	90 (75 %)	30 (25 %)	
Other	13 (1 %)	12 (92 %)	1 (8 %)	
Educational level				
Less than high school	94 (8 %)	70 (75 %)	24 (26 %)	0.65
High school graduate	493 (42 %)	389 (79 %)	104 (21 %)	
Associate/bachelors	359 (31 %)	284 (79 %)	75 (21 %)	
Advanced degree	224 (19 %)	171 (76 %)	53 (24 %)	
Marital status				
Married	686 (59 %)	542 (79 %)	144 (21 %)	0.79
Widowed	273 (23 %)	209 (77 %)	64 (23 %)	
Divorced	170 (15 %)	133 (78 %)	37 (22 %)	
Single	40 (3 %)	30 (75 %)	10 (25 %)	
Cancer type				
Breast	593 (51 %)	468 (79 %)	125 (21 %)	0.51
Heme malignancies	162 (14 %)	122 (75 %)	40 (25 %)	
Lung	119 (10 %)	89 (75 %)	30 (25 %)	
Other	297 (25 %)	237 (80 %)	60 (20 %)	
Phase of treatment				
Pre-treatment	293 (25 %)	230 (79 %)	63 (22 %)	0.15
During treatment	460 (40 %)	349 (76 %)	111 (24 %)	
Post-treatment	406 (35 %)	330 (81 %)	76 (19 %)	

[a] 140 patients (12 %) with one fall and 116 patients (10 %) with two or more falls

Table 3

Results of multivariable logistic regression analysis

Outcomes	Adjusted odds ratio	95 % CI
IADL (<14 vs. 14)	2.6***	1.9–3.5
Physical function (<20 vs. >20)	3.6**	1.8–7.3
TUG (≥14 vs. <14)	1.9***	1.4–2.6
Vision (excellent/good/fair vs. poor/gone)	3.4**	1.7–6.8
Hearing (excellent/good/fair vs. poor/gone)	1.9*	1.0–3.7
KPS patient (<80 vs. ≥80)	3.4***	2.4–4.9
KPS providers (<80 vs. ≥80)	3.0***	2.0–4.6
Medications (≥9 vs. <9)	1.6**	1.2–2.3
Comorbidities (0–3 vs. ≥4)	1.9***	1.4–2.6
BOMC (>11 vs. ≥11)	1.4	0.8–2.6
Weight Loss (≥5 vs. <5 % or none)	1.3	1.0–1.9
BMI (≥30, <30)	1.2	0.9–1.7
MHI-5 (<76 or ≥76)	2.5***	1.7-3.6

Each row presents the odds ratio from the multivariable model including that variable controlling for age, race, gender, education, and treatment stage

IADLs instrumental activities of daily living, *TUG* Timed Up and Go, *KPS* Karnofsky Performance Status, *BOMC* Blessed Orientation Memory Concentration test, *BMI* Body Mass Index, *MHI-5* Mental Health Index-5

* $p \leq 0.05$;

** $p \leq 0.001$;

*** $p \leq 0.0001$

Table 4

Results of multivariable logistic regression analysis for specific comorbidities

Comorbidity	Adjusted odds ratio	95 % CI
Arthritis	1.8***	1.3–2.4
Circulation trouble in arms or legs	1.6*	1.2–2.3
Stroke	2.4*	1.4–4.0
Depression	2.7***	1.9–3.7
High blood pressure	1.1	0.8–1.5
Diabetes	1.4	0.9–2.0
Heart disease	1.3	0.9–1.9
Number of comorbidities	1.2*	1.1–1.3

Each row presents the odds ratio from the multivariable model for each comorbidity, controlling for age, race, gender, education, and treatment stage

* $p \leq 0.05$;

** $p \leq 0.001$;

*** $p \leq 0.0001$