VIA MEDICA

ORIGINAL ARTICLE

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Evaluation of the Timed Up and Go test for screening vulnerability and frailty in older cancer patients

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Oncology in Clinical Practice
DOI: 10.5603/ocp.96855

ISSN 2450–1654
e-ISSN 2450–6478

ABSTRACT

Introduction. The need for comprehensive geriatric assessment (CGA) in older adults with cancer is increasing, which makes it necessary to have a screening instrument to identify those who would benefit from this evaluation. This study aimed to investigate diagnostic performance of the Timed Up and Go test (TUG) for identifying vulnerable or frail older adults with cancer who might benefit from CGA.

Material and methods. This observational and retrospective study took place at the geriatric center of Almenara Hospital in Lima, Peru We extracted CGA reports from electronic medical records of outpatients and inpatients aged 60 years and older with cancer, who were evaluated between November 2022 and July 2023. Patients were classified based on SIOG-2 (International Society of Geriatric Oncology) criteria as fit, vulnerable, or frail, based on scales including Activities of Daily Living (ADL), Instrumental ADL, Mini-Nutritional Assessment (MNA), Mini-Mental State Exam (MMSE), Geriatric Depression Scale, and Cumulative Illness Rating Scale-Geriatrics (CIRS-G). For the study, two groups were formed: fit patients and non-fit patients (vulnerable plus frail). We estimated sensitivity, specificity, and positive predictive values of the TUG test. The accuracy of the TUG test was analyzed using the area under the receiver operating characteristic curve (AUC).

Results. Among the 283 included patients, 154 were men (54.4%) and 129 women (45.6%), and the mean age was 76.8 ± 15.8 years. The most common neoplasms were colorectal (19.4%), stomach (15.2%), prostate (9.9%), and bile duct cancers (8.1%). The percentage of fit and non-fit patients was 21.9% and 78.1%, respectively. When the TUG test was equal to or greater than 15.5 seconds, sensitivity, specificity, positive predictive value, and AUC were 68.5% (95% CI 61.9–74.5), 88.5% (77.8–95.3), 95.6% (91.1–98.2), and 84.8% (0.80–0.90), respectively.

Conclusions. A TUG test result equal to or greater than 15.5 seconds demonstrated good screening properties for identifying older cancer patients who were vulnerable or frail and could benefit from CGA.

Keywords: timed up and go test, frailty, cancer, geriatric oncology, comprehensive geriatric assessment

Oncol Clin Pract 2024; 20, 1: 9–14

Introduction

Comprehensive geriatric assessment (CGA) is a multi-dimensional, multi-disciplinary diagnostic and therapeutic process that aims to identify medical, mental, and functional problems in frail older people. The goal is to develop a coordinated and integrated treatment plan and follow-up [1]. In older cancer patients, CGA is crucial for guiding therapeutic interventions and avoiding over- or under-treatment, especially in patients identified as vulnerable or frail [2–4].

Received: 07.08.2023 Accepted: 04.09.2023 Early publication date: 29.09.2023

One of the challenges of conducting a CGA is the time it takes. In older cancer patients, this procedure can range from 30 to 80 minutes, depending on the components and tools used [5–7]. Although simplified 10-minute versions of the CGA have been developed [8], the greatest benefits are observed in cancer patients classified as vulnerable or frail. For fit patients, especially in areas with a shortage of geriatric specialists or high workloads, this procedure may not be necessary [9].

A two-step frailty assessment strategy in older cancer patients involves using a screening instrument to prevent unnecessary CGA in fit patients. The second step is to perform a CGA in the selected vulnerable or frail patients [10]. This strategy can also facilitate referrals to centers with greater expertise in CGA, particularly in low-income countries. A recent systematic study investigated validated instruments to identify older cancer patients who may benefit from CGA [11]. The study found that two instruments, the Vulnerable Elders Survey (VES-13) [12] and the G8 geriatric screening tool [13], had the most evidence for usefulness. However, most of these studies did not report on the time required to administer each tool [11]. Additionally, a modified G8 has recently been released [14]. Another study using the net benefit approach found that both G8 and the modified G8 failed to demonstrate clinical value in prescreening for frailty across various tumor types, disease stages, and age groups [10].

The Timed Up and Go (TUG) test is used to measure functional mobility of older adults and assess their risk of falls [15]. It has also been studied in a group of older cancer patients, showing a predictive capacity for the risk of early death in onco-geriatric patients receiving chemotherapy [16]. The TUG test can predict the risk of postoperative complications [17] and increased 5-year mortality in older adults undergoing surgery for solid tumors [18]. However, the TUG has not been studied in relation to its ability to identify older adults with cancer who are vulnerable or frail. Therefore, this study aimed to investigate the diagnostic performance of the TUG in identifying vulnerable or frail older adults with cancer who might benefit from CGA.

Material and methods

Setting

An observational and retrospective study was conducted study was conducted at the Geriatric Department of the ESSALUD Almenara Hospital, a tertiary care hospital in Lima, Peru. We reviewed CGA reports stored in the electronic medical records of hospitalized or outpatient adult patients aged ≥ 60 years with a previous cancer diagnosis, who had been evaluated between November 2022 and July 2023. The study followed the Standards for Reporting Diagnostic Accuracy Studies (STARD) recommendations [19].

Comprehensive geriatric assessment

Comprehensive geriatric assessment was performed by two trained geriatricians, who assessed the following domains: function and mobility, nutritional status, cognition, mood, social environment, and comorbidities. Six CGA indicators were selected: functional impairment (Activities of Daily Living score, ADL ≤ 5/6) [20]; cognitive impairment: Mini-Mental State Examination (MMSE, Spanish version) score < 24/30 [21]; malnutrition defined as one or more of the following French National Authority for Health criteria: at least 10% weight loss in 6 months or 5% in 1 month, and/or body mass index less than 21 kg/m^2, and/or Mini-Nutritional Assessment (MNA-SF) score less than 12/14, and/or serum albumin level less than 35 g/L [22]; inadequate social environment defined as a score ≥ 10 on the Gijon social family assessment scale (Spanish version) [23]; verification of the diagnosis of depression in the medical history and use of antidepressants or depression diagnosed by a semi-structured interview to identify criteria for a major depressive episode from the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) [24]; and the number of severe (grade 3–4) comorbidities as assessed by the Cumulative Illness Rating Scale for Geriatrics (CIRS-G 0, 1, ≥ 2) [25]. Data was also collected on tumor site, metastatic status, age, sex, and in/outpatient status at the time of the CGA.

Timed Up and Go

The TUG test assesses the time a patient needs to get up from a chair, walk 3 meters, turn around, walk back, and sit down again [15]. This is measured in seconds with a handheld stopwatch. Two measurements were taken, and the average of these measurements was used in the study. The cut-off points for impaired TUG scores in older patients varied between 10 to 20 seconds [26]. The TUG test is an integral component of the CGA procedure in our center. Consequently, the results are routinely documented. However, it is important to note that the TUG test was not performed in patients who were unable to walk due to various reasons, such as being bedridden, dizziness, or knee pain, among others.

Vulnerability and frailty criteria

We used the frailty criteria of the International Society of Geriatric Oncology (SIOG-2) [27]. A patient is considered frail when they meet one of the following criteria: the presence of CIRS-G ≥ 1 grade 4 comorbidity, or ≥ 2 grade 3 comorbidities, or IADL score ≥ 7 of 8, or MMSE score < 24 of 30, or malnutrition (MNA-SF ≤ 7),

or ADL score ≤ 3 of 6. A patient is called vulnerable when they meet the following criteria: number of severe (grade 4) comorbidities = 0 (assessed by the CIRS-G), and IADL score > 7 of 8, and MMSE ≥ 24 of 30, and 1 grade 3 comorbidity, or ≥ 1 grade 2 comorbidity, or at risk for malnutrition (MNA-SF < 12), or ADL score 4 or 5 of 6, or depression. Finally, a patient is considered fit when they score > 14 of 17 on the G8 scale. For this study, patients were assigned into two groups: fit *vs.* non-fit (vulnerable plus frail).

Statistical analysis

In the descriptive analysis, measures of central tendency, dispersion, and absolute and relative frequencies were used. Categorical variables were described as counts and percentages, and quantitative variables as means [standard deviation (SD)] or medians (range) depending on distribution. The performance of the TUG test was evaluated using sensitivity, specificity, receiver operating curve (ROC), and area under the ROC curve (AUC). Confidence intervals (95% CI) were reported. For sensitivity and specificity analysis, patients who did not undergo the test due to being bedridden or wheelchair-bound were timed with the maximum TUG time detected in the study.

Ethical approval

This study was approved by the Research Ethics Committee of Almenara Hospital in Lima, Peru (approval number 80-CIEI-OIyD-GRPA-ESSALUD-2023, March 27, 2023). Necessary strategies were implemented to maintain confidentiality of patient information.

Results

A total of 283 patients were included in the study, with 54.4% of them being hospitalized at the time of the CGA. The mean age was 76.8 ± 15.8 years, and the sample comprised 154 men (54.4%) and 129 women (45.6%). The prevalence of malnutrition, depression, and cognitive disorders was 71.7%, 27.2%, and 39.8%, respectively. Furthermore, 51.6% of the patients had severe comorbidities (grade 3–4 CIRS-G), and 46.0% had functional impairment (Katz < 5/6). The ten most frequent types of tumors were colorectal (19.4%), stomach (15.2%), prostate (9.9%), bile ducts (8.1%), hematologic malignancy (lymphoma, leukemia) (8.1%), breast (4.6%), lung (4.6%), liver (4.2%), skin (4.2%), and pancreas (3.9%). The frequency of patients with metastases and those with two tumors of different origin were 26.9% and 6.4%, respectively (Tab. 1). According to the SIOG-2 classification, the prevalence of fit, vulnerable, and frail patients was 21.9%, 50.9%, and 21.2%, respectively.

Regarding the performance of the screening tool, the prevalence of fit and non-fit patients was 21.9% and 78.1%, respectively. When the TUG test results were equal to or greater than 15.5 seconds, sensitivity, specificity, positive predictive value, and AUC were 68.5% (95% CI 61.9–74.5), 88.5% (77.8–95.3), 95.6% (91.1–98.2), and 84.8% (0.80–0.90), respectively (Fig. 1). When the TUG analysis was conducted with 217 patients (excluding 66 of 283 who were unable to walk during the examination), the optimal cut-off point remained at 15.5 seconds. Sensitivity, specificity, positive predictive value, and area under the curve (AUC) were as follows: 55.1% (47.0–63.1), 88.5% (77.8–95.3), 92.5% (84.8–94.5), and 0.72 (0.66–0.77), respectively.

Discussion

Our study demonstrated that the TUG test, with an optimum cut-off value of 15.5 seconds, could serve as a valuable screening tool to identify vulnerable or frail older adults with cancer who could benefit from a CGA.

To our knowledge, this study is the first to use the TUG test as a screening tool before CGA in cancer patients, but it can be compared with other studies that used similar strategies. For example, gait speed (GS) measures the time needed for older patients to walk a certain distance at their usual speed [28]. Pamoukdjian et al. [29] assessed the diagnostic performance of GS for assessing vulnerability in older cancer patients and found that a GS < 1 m/s had sensitivity of 79.4%, specificity of 64.7%, and AUC of 82.0% (74.0––90.0%) [29]. However, GS faces challenges in clinical practice due to the lack of a standardized protocol and variations in measurement methods (e.g. distance walked, starting and deceleration procedures, timing, and type of testing surface) [30]. In contrast, the TUG test is a more internationally standardized option.

The G8 index and its modified version have also been used as screening instruments in older cancer patients. The G8 index showed sensitivity ranging from 76.5% to 87.2% and specificity from 17% to 65% in different studies [13, 14, 31], while the modified version had sensitivity from 89.2% to 89.3% and specificity from 64.7% to 79.0% [14, 29]. Additionally, the VES-13, used for the same purpose, showed sensitivity ranging from 39.0% to 67.8% and specificity from 64.4% to 84.4% [31, 32]. The mean time to complete the G8 or VES-13 is approximately five minutes [31].

Previous evidence supports the usefulness of the TUG test in older cancer patients, as it has been correlated with survival, treatment-related complications, cognitive function, global health decline, disability in activities of daily living, and sarcopenia in various studies [26, 33–35].

Table 1. Patient characteristics

Variable	Total patients (n = 283)		Fit (n = 61) (21.6%)		Non-fit (vulnerable+ frail*) n = 222 (78.5%)	
	n	%	n	%	n	%
Sex						
Male	154	54.4%	40	65.6%	114	51.4%
Female	129	45.6%	21	34.4%	108	48.7%
Indicators						
Inadequate social environment	13	4.6%	2	3.3%	11	5.0%
Malnutrition	203	71.7%	6	9.8%	197	88.7%
Depression (DSM IV criteria)	77	27.2%	1	1.6%	76	34.2%
Cognitive impairment (MMSE < 24/30)	112	39.6%	0		112	50.5%
No. of severe comorbidities (grade 3–4 CIRS-G)						
0	137	48.4%	61	100.0%	76	34.2%
1	120	42.4%	0		120	54.1%
≥ 2	26	9.2%	0		26	11.7%
Functional impairment (Katz; ADL score < 5 of 6)	130	45.9%	0		130	58.6%
Outpatient at time of CGA	129	45.6%	28	45.9%	101	45.5%
Tumor site						
Colorectal	55	19.4%	8	13.1%	47	21.2%
Stomach	43	15.2%	5	8.2%	38	17.1%
Prostate	28	9.9%	8	13.1%	20	9.0%
Bile ducts	23	8.1%	7	11.5%	16	7.2%
Hematologic malignancy (lymphoma, leukemia)	23	8.1%	5	8.2%	18	8.1%
Breast	13	4.6%	5	8.2%	8	3.6%
Lung	13	4.6%	3	4.9%	10	4.5%
Liver	12	4.2%	5	8.2%	7	3.2%
Skin	12	4.2%	4	6.6%	8	3.6%
Pancreas	11	3.9%	3	4.9%	8	3.6%
Kidney	10	3.5%	2	3.3%	8	3.6%
Head and neck	7	2.5%	2	3.3%	5	2.3%
Brain	6	2.1%	0		6	2.7%
Endometrium	3	1.1%	0		3	1.4%
Bladder	3	1.1%	0		3	1.4%
Ovary	2	0.7%	1	1.6%	1	0.5%
Other/unknown primary sites	19	6.70%	3	4.9%	16	7.2%
Two tumor sites	18	6.36%	3	4.9%	15	6.8%
Metastatic status	76	26.86%	10	16.4%	66	29.7%

*Classification of the International Society of Geriatric Oncology (SIOG-2); CGA — comprehensive geriatric assessment; CIRS-G — Cumulative Illness Rating Scale-Geriatrics; DSM-IV — Diagnostic and Statistical Manual of Mental Disorders; MMSE — Mini-Mental State Exam

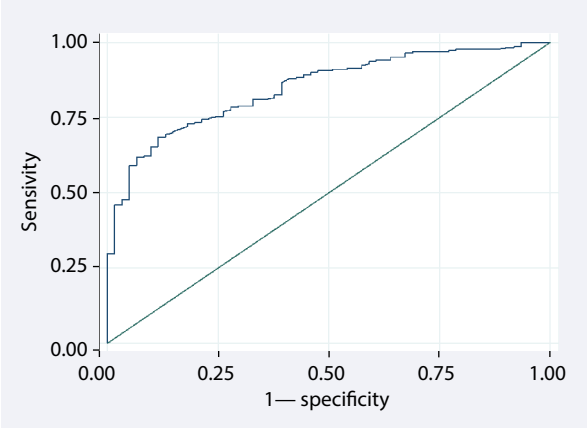

Figure 1. Evaluation of the Timed Up and Go test to screen for vulnerability and frailty in older cancer patients: Receiver operating characteristic (ROC) curve; receiver operating characteristic curve (AUC) = 84.8% (0.800–0.897)

However, our study has some limitations. The criteria used to select fit and non-fit patients (vulnerable plus frail) and evaluate TUG's performance were based on SIOG-2 criteria [27, 36], whereas studies evaluating G8 and VES-13 used different cut-off points for each CGA scale [13]. Additionally, our study was conducted in a group of patients with a high prevalence of frailty, and further research is needed in patients with a lower prevalence of frailty. This is because diagnostic test studies in high-prevalence disease groups may lead to variations in predictive values, increasing the positive predictive value. In addition, the cut-off of > 15.5 is internally valid to our sample and not necessarily externally generalizable, further research is needed in different settings before an international TUG cut-off value can be recommended.

Conclusions

In conclusion, the TUG test with a cut-off of > 15.5 seconds showed promising sensitivity, specificity, positive predictive value, and AUC in identifying older adult cancer patients who may require CGA. This test could be beneficial, especially in hospitals with high demand for geriatric evaluation or a limited number of specialists.

Article Information and Declarations

Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restriction.

Ethics statement

This study was approved by the Research Ethics Committee of Almenara Hospital in Lima, Peru (letter 80-CIEI-OIyD-GRPA-ESSALUD-2023, March 27, 2023). The necessary strategies were implemented to maintain the privacy of patient information.

Author contributions

T.J.O.: concept and design, drafting of the manuscript, critical revision of the manuscript for important intellectual content; E.C-M.: acquisition, analysis, interpretation of the data, critical revision of the manuscript for important intellectual content; X.V.: acquisition, analysis, interpretation of the data, critical revision of the manuscript for important intellectual content; R.R.-O.: drafting of the manuscript, critical revision of the manuscript for important intellectual content, supervision.

Funding

None.

Acknowledgments

None.

Conflict of interest

The authors have no conflicts of interest to disclose.

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