Comprehensive Geriatric Assessment in the Decision-Making Process in Elderly Patients With Cancer: ELCAPA Study

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ABSTRACT

Purpose
To identify Comprehensive Geriatric Assessment (CGA) components independently associated with changes in planned cancer treatment.

Patients and Methods
We prospectively included 375 consecutive elderly patients with cancer (ELCAPA01 study) assessed by geriatricians using the CGA. Multivariate analysis was used to identify factors associated with changes in the cancer treatment (intensification, decrease, or delayed changes). Change was defined as a difference between the initial treatment proposal and the final treatment selected in a multidisciplinary meeting.

Results
Mean age was 79.6 years (standard deviation [SD], 5.6 years), and 197 (52.5%) were women. The most common tumor location was the digestive system (58.7%). The mean number of comorbidities was 4.2 (SD, 2.7) per patient, and the mean Cumulative Illness Rating Scale for Geriatrics score was 11.8 (SD, 5.3). After the CGA, the initial cancer treatment plan was modified for 78 (20.8%) of 375 patients (95% CI, 16.8 to 25.3), usually to decrease treatment intensity (63 [80.8%] of 78 patients). By univariate analysis, cancer treatment changes were associated with Eastern Cooperative Oncology Group performance status ≥ 2 (73.3% in the group with changes v 41.1% in the group without changes; P < .001), dependency for one or more activities of daily living (ADL; 59.0% v 24.2%; P < .001), malnutrition (81.8% v 51.2%; P < .001), cognitive impairment (38.5% v 24.9%; P = .023), depression (52.6% v 21.7%; P < .001), and greater number of comorbidities (mean, 4.8 [SD, 2.9] v 4.0 [SD, 2.6]; P = .02). By multivariate analysis, factors independently associated with cancer treatment changes were a lower ADL score (odds ratio [OR], 1.25 per 0.5-point decrease; CI, 1.04 to 1.49; P = .016) and malnutrition (OR, 2.99; CI, 1.36 to 6.58; P = .007).

Conclusion
Functional status assessed by the ADL score and malnutrition were independently associated with changes in cancer treatment.

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INTRODUCTION

The management of elderly patients with cancer has become a major public health concern in Western countries because of the aging of the population and steady increase in cancer incidence with advancing age. Today, greater than 60% of all cancers are diagnosed in patients older than 65 years in Europe and the United States. This percentage is expected to increase to 70% within the next 30 years.1-3

Studies have shown deficiencies in the management of elderly patients with cancer,4-7 including inadequate screening,8-10 incomplete investigation of the malignancy,11 diagnostic delays, and suboptimal treatment.12 These factors, associated with undertreatment of elderly cancer patients, may lead to decreased survival.13-15

The heterogeneity of the elderly population in terms of comorbidities and functional status may largely explain the difficulty in establishing management recommendations. The Comprehensive Geriatric Assessment (CGA) developed by geriatricians is a multidimensional assessment of general health status; comorbidities; functional status; nutritional, cognitive, psychological, and social parameters; and medications. The CGA uses validated geriatric scales
to produce an inventory of problems, which can then serve to develop an individualized geriatric intervention plan. A meta-analysis showed that this global medical and environmental approach, complemented by a multidisciplinary intervention, improved survival, functional status, and institutionalization rates in patients with nonmalignant diseases.16

Over the past decade, the CGA has been proposed as a tool for managing elderly patients with cancer.17-24 Given that the CGA estimates the chances of living in the individual patient and detects comorbidities, it may be an important step in selecting elderly patients for cancer screening and treatment.25-26

CGA has been suggested as a useful geriatric oncology tool22,24 for separating patients likely to benefit from standard cancer treatment and patients who are at high risk for complications and/or are too vulnerable to receive aggressive therapy. However, the best CGA format for use in geriatric oncology has not been determined. CGA is time consuming, and several abbreviated CGAs have been developed, but the validity of these has not been tested in elderly patients with cancer. We are aware of two studies of the impact of abbreviated CGAs on the care of elderly patients with cancer.22,24 Only one used a systematic extensive multidimensional geriatric assessment to assess factors that were independently associated with the treatment decision.29

The objectives of this study were to evaluate whether CGA influenced cancer treatment decisions and to identify which CGA parameters were associated with cancer treatment changes.

PATIENTS AND METHODS

Study Design and Data Collection

The ELCAPA (ie, elderly cancer patient) survey is a prospective study that included all patients age 70 years or older who had a diagnosis of solid cancer (excluding hematologic malignancies) in a teaching hospital (approximately 1,300 beds), in the Paris conurbation, France. For the present study (ie, ELCAPA01), conducted between January 2007 and July 2009, we prospectively included 392 patients who were referred to the oncologic-geriatric unit by oncologists, radiation therapists, or surgeons (Fig 1). Among the 392 patients, 17 had no defined cancer treatment proposal and were therefore excluded from this analysis; 375 patients remained for the study.

A geriatrician performed an extensive CGA that included a complete clinical examination during the oncologic-geriatric visit (120 minutes). At the end of the CGA, the geriatrician proposed a geriatric intervention plan for overall patient management (eg, social support, nutrition, psychological support, physiotherapy, memory assessment, modification of current drugs, and/or investigations). After the oncologic-geriatric evaluation and the CGA, a multidisciplinary meeting was held for discussion of each patient and decisions about the cancer treatment. Figure 1 recapitulates the management of the study patients.

The cancer treatment plan was a combination of one or more of the following five modalities: surgery, chemotherapy, hormonal therapy, radiotherapy, and supportive care (SC). The cancer treatment plan was considered changed when the cancer treatment chosen after the multidisciplinary meeting differed from the cancer treatment initially proposed by the oncologists (Fig 1). Changes in cancer treatment plans were categorized as follows: treatment intensification via the addition of one or more modalities; decrease in cancer treatment intensity via the removal of at least one modality or replacement of specific cancer treatment by SC; and postponement of cancer treatment for 2 weeks or longer.

The following data were collected on a standardized case report form: age and sex; Eastern Cooperative Oncology Group performance status (ECOG PS); location and stage of the tumor; cancer treatment proposed by the oncologists before the CGA; overall management recommended by the geriatrician; cancer treatment chosen after the CGA; and CGA variables.

The CGA included an evaluation of nine domains according to international recommendations. Domains were functional status, mobility, nutritional status,22-24 cognitive status,30 mood,31 comorbidities,32 polypharmacy,33 social environment,34 and urinary and/or fecal incontinence. Functional status was measured by using the six-item Activities of Daily Living (ADL) score.28 Dependency was defined as loss of self-sufficiency for one or more ADLs.

Falls in the past 6 months and walking problems were recorded. The fall risk was assessed on the basis of the timed get-up-and-go test37 and the one-leg standing balance test.37 Mobility was considered impaired when one or both tests were abnormal (timed get-up-and-go score ≥ 3 of 4 and/or completion time > 20 seconds; one-leg standing balance test < 5 seconds on one or both sides).

Nutritional status was estimated as recommended by the French National Authority of Health.36 Malnutrition was defined as presence of one or more of the following criteria: at least a 10% weight loss in 6 months or 5% in 3 months and/or body mass index (BMI) less than 21 kg/m² and/or Mini Nutritional Assessment29 score less than 17 of 30 and/or albumin less than 35 g/L.

Cognitive status was assessed by using the Mini-Mental State Examination (MMSE). Scores lower than 24 of 30 were taken to indicate cognitive impairment.40 Mood was assessed using the four-item Mini-Geriatric Depression Scale (Mini-GDS).41 Scores equal to or greater than one of four were taken to suggest a depressive disorder.

For each patient, the following comorbidities were recorded: coronary artery disease, chronic heart failure (New York Heart Association classes III and IV), cardiac arrhythmia, hypertension (≥ 140/90 mmHg), diabetes mellitus, chronic obstructive pulmonary disease, renal insufficiency (creatinine clearance < 50 mL/min), cirrhosis, and neurologic sequelae of stroke. The Cumulative Illness Rating Scale for Geriatrics (CIRS-G) was also used to assess the severity of comorbidities.42-43 Polypharmacy was defined as taking five or more oral medications each day.

The social environment was considered good if the patient had a primary caregiver, support at home, or a strong circle of friends and family capable of meeting the patient’s needs at the time of the evaluation. Otherwise, the social environment was considered inappropriate. We also identified patients who were living alone.

Finally, we summarized the total number of altered CGA parameters by coding each parameter as 0 (unaltered) or 1 (altered). The parameters were
inappropriate social environment, dependency for one or more ADLs, high fall risk, malnutrition, cognitive impairment, depressive mood, urinary and/or fecal incontinence, polypharmacy, and more than four comorbidities (four was the median).

Informed consent was obtained from all study patients before inclusion. The protocol was approved by the institutional review board of the Henri Mondor Teaching Hospital, Creteil, France.

Sample Size Estimation
On the basis of two previous studies, we expected the planned cancer treatment to be changed in 35% of patients. To detect this rate of change with 5% accuracy and 5% a risk, 350 patients were needed. We included 375 patients.

Data Analysis
Patient characteristics and CGA variables were described as numbers and percentages for qualitative variables and means with SDs or medians with 25th and 75th percentiles (quartile 1 to quartile 3), as appropriate, for quantitative variables. To look for factors potentially associated with changing the cancer treatment, we first performed univariate analyses by using the χ² test or Fisher’s exact test for qualitative variables and t test or nonparametric Wilcoxon–Mann–Whitney test for quantitative variables. Variables yielding P values less than .15 by univariate analysis were considered for the multivariate analysis. Because of collinearity between the number of altered CGA parameters and each CGA parameter taken separately and among the CIRS-G score, we included at most five of them for which the information was available.

To detect this rate of change with 5% accuracy and 5% a risk, 350 patients were needed. We included 375 patients.

RESULTS

We included 375 patients with a mean age of 79.6 years (SD, 5.6 years). Their main characteristics are listed in Table 1. The most common cancers affected the digestive system (58.7%).

The CGA results are listed in Table 2. Hypertension and renal insufficiency were the most common comorbidities. Renal insufficiency (creatinine clearance < 50 mL/min) was present in 62.2% of...
patients, and renal failure (creatinine clearance < 30 mL/min) was present in 16.1%. The mean number of comorbidities was 4.2 per patient (SD, 2.7). The median number of altered CGA parameters was three (Q1 to Q3, 2 to 5).

In the overall cohort (N = 375), the initially proposed cancer treatment was surgery in 112 patients (29.9%), chemotherapy in 197 patients (52.5%), radiotherapy in 72 patients (19.2%), hormonal therapy in 46 patients (12.3%), and SC in 36 patients (9.6%). The cancer treatments selected by multidisciplinary meetings were surgery in 89 patients (23.7%), chemotherapy in 146 patients (39.5%), radiotherapy in 72 patients (19.2%), hormonal therapy in 46 patients (12.3%), and SC in 36 patients (9.6%). The mean number of comorbidities was 4.2 per patient. Few changes occurred for radiotherapy and hormonal therapy: radiotherapy was scheduled initially in 52 patients (70.5%) but was dropped in 10 (13.8%) patients, and hormonal therapy was selected in eight patients (10.2%) instead of 10 (12.8%).

The univariate analyses comparing patients with (n = 78) and without (n = 297) treatment changes are listed in Table 4. Patients with changes had a poorer performance status (P < .001). For all CGA parameters, the proportions of patients with alterations were significantly larger in the group with treatment changes than in the group without treatment changes. The median number of altered CGA parameters was five (Q1 to Q3, 4 to 6) in the group with treatment changes versus three (Q1 to Q3, 1 to 4) in the group without changes (P < .001).

In the multivariate analysis (Table 5), factors independently associated with changing the initial cancer treatment plan were functional impairment (OR per 0.5-point decrease in the ADL score, 1.25; 95% CI, 1.04 to 1.49) and malnutrition (2.99; 95% CI, 1.36 to 6.58). Nonsignificant trends toward an association with treatment changes were found for depression (1.84; 95% CI, 0.89 to 3.80; P = .10) and higher number of comorbidities (OR per additional comorbidity, 1.09; 95% CI, 0.98 to 1.23; P = .11). The model had adequate discrimination and calibration (Hosmer-Lemeshow statistic, P = 0.39; area under the receiver operating characteristic curve, 0.79). After excluding the 15 patients in whom the treatment changes consisted of increased treatment intensity or delayed treatment, the multivariate analysis identified the same two independent factors, ADL score (OR, 1.26; 95% CI, 1.15 to 1.4) and depression (OR, 1.84; 95% CI, 0.89 to 3.80; P = .10).

### Table 3. Initial and Final Cancer Treatment Plans in the 78 Patients With Changes After CGA

<table>
<thead>
<tr>
<th>Initial Cancer Treatment Plan</th>
<th>Patients on Initial Treatment Plan</th>
<th>Final Cancer Treatment Plan</th>
<th>Patients on Final Treatment Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intensification of cancer treatment</td>
<td>No.</td>
<td>%</td>
<td>No.</td>
</tr>
<tr>
<td>Supportive care</td>
<td>3</td>
<td>3.8</td>
<td>Radiotherapy</td>
</tr>
<tr>
<td>Surgery</td>
<td>3</td>
<td>3.8</td>
<td>Surgery + chemotherapy</td>
</tr>
<tr>
<td>Hormonal therapy</td>
<td>2</td>
<td>2.6</td>
<td>Hormonal therapy + radiotherapy</td>
</tr>
<tr>
<td>Delay in cancer treatment</td>
<td>No.</td>
<td>%</td>
<td>No.</td>
</tr>
<tr>
<td>Surgery + chemotherapy</td>
<td>1</td>
<td>1.3</td>
<td>Nutritional care</td>
</tr>
<tr>
<td>Chemotherapy</td>
<td>5</td>
<td>6.4</td>
<td>Nutritional care (n = 5); antibiotic therapy</td>
</tr>
<tr>
<td>Chemotherapy + radiotherapy</td>
<td>1</td>
<td>1.3</td>
<td>Nutritional care + functional rehabilitation</td>
</tr>
<tr>
<td>Decrease in cancer treatment intensity</td>
<td>No.</td>
<td>%</td>
<td>No.</td>
</tr>
<tr>
<td>Surgery</td>
<td>10</td>
<td>12.8</td>
<td>Supportive care</td>
</tr>
<tr>
<td>Surgery + chemotherapy</td>
<td>2</td>
<td>2.6</td>
<td>Supportive care</td>
</tr>
<tr>
<td>Surgery + chemotherapy + radiotherapy</td>
<td>3</td>
<td>3.8</td>
<td>Supportive care</td>
</tr>
<tr>
<td>Surgery + hormonal therapy</td>
<td>1</td>
<td>1.3</td>
<td>Radiotherapy</td>
</tr>
<tr>
<td>Surgery + radiotherapy + hormonal therapy</td>
<td>2</td>
<td>2.6</td>
<td>Radiotherapy + hormonal therapy</td>
</tr>
<tr>
<td>Chemotherapy</td>
<td>38</td>
<td>48.7</td>
<td>Supportive care</td>
</tr>
<tr>
<td>Chemotherapy + hormonal therapy</td>
<td>2</td>
<td>2.6</td>
<td>Supportive care</td>
</tr>
<tr>
<td>Chemotherapy + radiotherapy</td>
<td>1</td>
<td>1.3</td>
<td>Chemotherapy</td>
</tr>
<tr>
<td>Chemotherapy + radiotherapy + hormonal therapy</td>
<td>2</td>
<td>2.6</td>
<td>Radiotherapy + hormonal therapy</td>
</tr>
<tr>
<td>Radiotherapy</td>
<td>1</td>
<td>1.3</td>
<td>Supportive care</td>
</tr>
<tr>
<td>Radiotherapy + hormonal therapy</td>
<td>1</td>
<td>1.3</td>
<td>Hormonal therapy</td>
</tr>
</tbody>
</table>

Abbreviation: CGA, Comprehensive Geriatric Assessment.
In the overall study population (N = 375), the geriatricians made the following proposals for overall patient management on the basis of the CGA results: change in prescribed medications for 115 patients (30.7%), social support for 172 patients (45.9%), physical therapy for 157 patients (41.9%), nutritional care for 262 patients (69.9%), psychological care for 134 patients (35.7%), and investigations for 206 patients (54.9%). Investigations were performed to obtain baseline data to guide cancer treatment and/or global patient management. They consisted chiefly of consultation with cardiologists, neurologists, ophthalmologists, and pain specialists; echocardiography (n = 45 [21.8%] of 206 patients); other imaging investigations (n = 21 [10.2%] of 206 patients), such as computed tomography, bone mineral density measurement, and plain radiographs; and laboratory tests (n = 107 [51.9%] of 206 patients).

### DISCUSSION

In our elderly population with cancer, nearly 21% of patients had changes made to their initial cancer treatment plan on the basis of the CGA results. The most common change was a switch from chemotherapy to SC. Two factors were independently associated with changing the initial cancer treatment: functional impairment (defined as an at least 0.5-point ADL score decrease) and malnutrition.

The three studies that previously assessed changes in cancer treatment that were based on CGA results produced similar results to those of our study. In a study of 15 patients with early-stage breast cancer, CGA results led to changes in the planned cancer treatment in four of the 11 patients for whom follow-up data were available.27 A study of 105 patients with a variety of cancers showed that the planned treatment was changed on the basis of the CGA findings in 38.7% of patients.28 In keeping with our findings, the most common changes affected chemotherapy (ie, change in the protocol or dose, or use of less aggressive treatment options).28 However, this study involved only univariate analysis and found that malnutrition (defined as BMI ≤ 23 kg/m²) and absence of depression were associated with treatment changes.28 By multivariate analysis, we found that changing the initial cancer treatment plan was independently associated with two factors, namely functional impairment (ADL score) and malnutrition. Functional impairment, defined as dependency for one or...
more ADLs, was present in 31.5% of our patients compared with 16.4% to 69% of patients in the earlier studies.38-46 These variations may be related to differences in patient age and cancer type. In a previous study, ADL score was also independently associated with changing the planned cancer treatment (with an increase in palliative care).39 Moreover, in a study of 1,009 elderly patients with colorectal cancer, having two or more functional limitations was associated with increased all-cause mortality.40 Similarly, a study of 660 women with breast cancer who were age 65 years or older found that having one functional limitation independently predicted mortality.41 In a prospective study of surgical cancer treatment, which included 460 patients (mean age, 76.9 years; SD, 5.2 years), a preoperative PS greater than 1 was associated with the occurrence of postoperative complications, whereas dependency for ADLs did not.42 In keeping with a previous study, our results suggest that ADL may be more informative than PS for characterizing the functional status of elderly patients with cancer.43

Malnutrition was the other factor independently associated with changing the initial cancer treatment plan in this study. Malnutrition was a feature in 57.5% of our patients, among whom 58.7% had cancers involving the digestive system. In earlier studies, malnutrition was found in 45.6% of 105 patients with breast cancer (median age, 79 years)27 and in 77% of 57 patients with lung cancer.29 Malnutrition is recognized as an important prognostic factor in patients scheduled for cancer chemotherapy.51 Our finding that malnutrition was independently associated with changing the cancer treatment plan is consistent with a study by Mareno et al,26 in which a BMI less than 21 kg/m² influenced the treatment decisions (about increasing the use of palliative care). Of note, in this study, malnutrition was defined not only on the basis of BMI but also on the basis of weight loss in the past 6 or 3 months, a Mini Nutritional Assessment score less than 17 of 30, and a low serum albumin level.

In addition to contributing to decisions about cancer treatment, the CGA is valuable for developing care programs tailored to individual patients.52 Such programs may include interventions to correct identified geriatric factors and reversible comorbidities. The high prevalence of problems detected by the CGA explained the large number of interventions recommended or implemented by geriatricians in our population and in earlier studies. In 15 patients with early-stage breast cancer, the mean number of interventions during the 6-month follow-up was 17 per patient.52 In this study, the most common interventions were social support, physiotherapy, and nutritional measures. The use of physiotherapy and nutritional interventions was consistent with our finding that impaired functional status and malnutrition were the two CGA components independently associated with changing the cancer treatment.

Several limitations to this study should be borne in mind. The oncologists did not routinely refer elderly patients with cancer to the geriatric oncology clinic. Thus, of 656 elderly patients with cancer, only 392 (59.8%) were referred. This may have introduced selection bias, with only the most vulnerable patients being included in our study. The applicability of our results to the overall population of elderly patients with cancer, therefore, must be viewed with caution. However, our population included patients with a wide variety of cancers at various stages (from localized to metastatic). The CGA was performed at various times in the course of cancer management, before treatment initiation in some patients, and during treatment in others, sometimes after several lines of therapy (eg, surgery, radiotherapy, chemotherapy, hormonal therapy). Studies in specific cancer types would be useful.

This study also has a number of important strengths. To our knowledge, it is the second largest study of the impact of extensive CGA on cancer treatment. We systematically used international validated scales to assess the different domains of the CGA according to international recommendations. Finally, the use of multivariate analysis in this study allowed us to identify two factors independently associated with changing the cancer treatment.

In conclusion, CGA found a high prevalence of geriatric factors in older patients with cancer and prompted changes in the planned cancer treatment in more than 20% of patients. Functional impairment and malnutrition were independently associated with changing the cancer treatment. Prospective studies are needed to assess the impact of CGA in global and specific cancer mortality, readmission, functional status, and quality of life in elderly patients with cancer.

**Table 5. Multivariate Analysis to Identify Factors Independently Associated With Changing the Cancer Treatment**

<table>
<thead>
<tr>
<th>Factor</th>
<th>OR</th>
<th>95% CI</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECOG PS 1-point increase</td>
<td>1.07</td>
<td>0.72 to 1.59</td>
<td>.74</td>
</tr>
<tr>
<td>Inappropriate social environment</td>
<td>1.34</td>
<td>0.61 to 2.95</td>
<td>.46</td>
</tr>
<tr>
<td>ADL 5-point decrease</td>
<td>1.25</td>
<td>1.04 to 1.49</td>
<td>.016</td>
</tr>
<tr>
<td>Walking problems: risk of falls</td>
<td>1.27</td>
<td>0.53 to 3.03</td>
<td>.54</td>
</tr>
<tr>
<td>Malnutrition</td>
<td>2.99</td>
<td>1.36 to 6.58</td>
<td>.007</td>
</tr>
<tr>
<td>Cognitive impairment</td>
<td>0.93</td>
<td>0.44 to 2.00</td>
<td>.86</td>
</tr>
<tr>
<td>Depressive disorder</td>
<td>1.84</td>
<td>0.89 to 3.80</td>
<td>.10</td>
</tr>
<tr>
<td>Polypharmacy</td>
<td>1.72</td>
<td>0.72 to 4.14</td>
<td>.22</td>
</tr>
<tr>
<td>Urinary and/or fecal incontinence</td>
<td>1.09</td>
<td>0.45 to 2.64</td>
<td>.84</td>
</tr>
<tr>
<td>No. of comorbidities by 1-point increase</td>
<td>1.09</td>
<td>0.98 to 1.22</td>
<td>.11</td>
</tr>
</tbody>
</table>

NOTE. Multivariate analysis using a logistic regression model that included factors listed in the table: ECOG PS, inappropriate social environment, 1-point ADL score decrease, walking problems/risk of falls, malnutrition, cognitive impairment, depressive disorder, polypharmacy, incontinence, and 1 point per additional comorbidity.

Abbreviations: OR, odds ratio; ECOG PS, Eastern Cooperative Oncology Group performance status; ADL, Activities of Daily Living.
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