Assessment of Solid Cancer Treatment Feasibility in Older Patients: A Prospective Cohort Study

MARIE LAURENT,^{a,b} ELENA PAILLAUD,^{a,b} CHRISTOPHE TOURNIGAND,^c PHILIPPE CAILLET,^{a,b} AURÉLIE LE THUAUT,^{a,d,e} JEAN-LÉON LAGRANGE,^f OLIVIER BEAUCHET,^h HÉLÈNE VINCENT,ⁱ MURIEL CARVAHLO-VERLINDE,^g STÉPHANE CULINE,^j SYLVIE BASTUJI-GARIN,^{a,d,e}

FLORENCE CANOUI-POITRINE,^{a,d} ON BEHALF OF THE ELCAPA STUDY GROUP

^aUniversité Paris Est, Faculté de Médecine, LIC, EA4393 Créteil, France; ^bDépartement de Médecine Interne et Gériatrie, Unité de Coordination d'Onco-Gériatrie (UCOG-Sud Val de Marne), ^cService d'Oncologie Médicale, ^dService de Santé Publique, ^eUnité de Recherche Clinique, ^fService de Radiothérapie, and ^gService de Pharmacie, AP-HP, Hôpital Henri-Mondor, Créteil, France; ^hCentre hospitalier universitaire, Département de Neurosciences, Division Médecine gériatrique Angers, France; ⁱAP-HP Hôpital Paul Brousse, Service de soins de suite polyvalents, Villejuif, France; ^jAP-HP, Hôpital Saint-Louis, Service d'Oncologie Médicale, Paris, France

Disclosures of potential conflicts of interest may be found at the end of this article.

Key Words. Feasibility studies • Elderly • Cancer • Treatment • Chemotherapy

ABSTRACT

Purpose. To assess solid cancer treatment feasibility in older patients

Methods. Between 2007 and 2010, 385 consecutive elderly patients (mean age: 78.9 ± 5.4 years; 47.8% males) with solid malignancies referred to two geriatric oncology clinics were included prospectively. We recorded feasibility of first-line chemotherapy (planned number of cycles in patients without metastases and three to six cycles depending on tumor site in patients with metastases), surgery (patient alive 30 days after successfully performed planned surgical procedure), radiotherapy (planned dose delivered), and hormonal therapy (planned drug dose given), and we recorded overall 1-year survival.

Results. Main tumor sites were colorectal (28.6%), breast (23.1%), and prostate (10.9%), and 47% of patients had metastases. Planned cancer treatment was feasible in 65.7% of patients with metastases; this proportion was 59.0% for

chemotherapy, 82.6% for surgery, 100% for radiotherapy, and 85.2% for hormonal therapy. In the group without metastases, feasibility proportions were 86.8% overall, 72.4% for chemotherapy, 95.7% for surgery, 96.4% for radiotherapy, and 97.9% for hormonal therapy. Factors independently associated with chemotherapy feasibility were good functional status defined as Eastern Cooperative Oncology Group performance status <2 ($p < .0001$) or activities of daily living >5 ($p = .01$), normal mobility defined as no difficulty walking ($p = .01$) or no fall risk ($p = .007$), and higher creatinine clearance ($p = .04$).

Conclusion. Feasibility rates were considerably lower for chemotherapy than for surgery, radiotherapy, and hormonal therapy. Therefore, utilization of limited geriatric oncology resources may be optimized by preferential referral of elderly cancer patients initially considered for chemotherapy to geriatric oncology clinics. *The Oncologist* 2014;19:275–282

Implications for Practice: Among cancer treatment modalities, surgery, hormonal therapy, and radiotherapy were usually feasible in older patients seen in everyday practice. Feasibility was lowest for chemotherapy (72.4% and 59%, respectively, in the groups without and with metastasis). Functional status, mobility, metastasis status, and creatinine clearance were independently associated with chemotherapy feasibility, whereas age was not. Given the growing number of older patients with cancer, the limited number of geriatricians, and the time-consuming nature of the Comprehensive Geriatric Assessment, those older cancer patients considered for chemotherapy may benefit the most from referral to a geriatric oncology clinic before the final treatment decision.

INTRODUCTION

Cancer is among the leading causes of death in industrialized countries [1]. The incidence of cancer rises with age, with an 11-fold increase after age 65 compared with younger age groups [1], and more than 30% of all cancers are diagnosed in patients aged 75 years or older [2]. Cancer treatment strategies involve

variable combinations of surgery, chemotherapy, targeted therapies, hormonal therapy, and radiotherapy in older patients. Although the treatment strategy is chiefly dictated by histology, tumor site, and tumor stage [3], individually tailored strategies are increasingly being used, most notably in

Correspondence: Florence Canoui-Poitaine, M.D., Ph.D., Service de Santé Publique, Hôpital Henri Mondor, 51, avenue du Maréchal de Lattre de Tassigny, 94010 Créteil Cedex, France. Telephone: +33-149-813-695; E-Mail: florence.canoui-poitaine@hmn.aphp.fr Received September 6, 2013; accepted for publication December 9, 2013; first published online in *The Oncologist Express* on February 25, 2014. ©AlphaMed Press 1083-7159/2014/\$20.00/0 <http://dx.doi.org/10.1634/theoncologist.2013-0351>

older patients. Data from pivotal randomized controlled trials suggest similar feasibility and survival benefits of cancer treatment in younger and older patients [4–9]; however, the older patients included in these trials were usually selected based on good general health [10] with few comorbidities and good performance status [11]. Consequently, the general applicability of the trial findings to the overall population of older patients with cancer is in doubt. Several observational studies [12–16] showed that older patients with cancer were less often treated than their younger counterparts, the main reason being concern about side effects of treatment [16–18]. Furthermore, a few studies indicated that premature cancer treatment discontinuation was more common among older than middle-aged cancer patients and seemed associated with poorer outcomes [19, 20]. Accurately assessing discontinuation rates for each treatment modality would help to identify patient groups at high risk for early discontinuation. Several studies focused on the feasibility of chemotherapy, but only one concomitantly assessed the feasibility of the various treatment modalities in the same population [21]. In studies involving a Comprehensive Geriatric Assessment (CGA) at baseline, malnutrition, cognitive impairment [22], and comorbidities were independently associated with chemotherapy feasibility [23]. To our knowledge, a single study in elderly cancer patients (who had metastatic colorectal cancer) simultaneously evaluated associations linking oncologic and geriatric parameters to chemotherapy feasibility [24].

The objective of this study in older patients with solid cancer was to assess the frequency of treatment feasibility and to identify CGA factors associated with treatment feasibility.

PATIENTS AND METHODS

Study Design

The Elderly Cancer Patient (ELCAPA) study is a prospective open-cohort survey of consecutive patients aged 70 years or older with histologically confirmed cancer who are referred by an oncologist, a radiotherapist, a surgeon, or other specialist to one of two geriatric oncology clinics in teaching hospitals in the Paris urban area of France. For the present analysis, ELCAPA-03, we included all ELCAPA patients with solid cancer for whom a treatment strategy was established during a multidisciplinary meeting between January 2007 and December 2010. Patients scheduled for supportive care only were not included. The study inclusion date was the date of the first geriatric oncology visit.

This observational study is reported according to the Strengthening the Reporting of Observational Studies in Epidemiology statement [25].

Informed consent was obtained from all study patients prior to inclusion. The protocol was approved by the local ethics committee (Comité de Protection des Personnes Ile-de-France I, Paris, France).

Data Collection

The data were collected prospectively. At baseline, age, gender, tumor characteristics (site, metastatic status, and number and location of metastases), and pretreatment laboratory data (creatinine, albumin, and C-reactive protein) were recorded. Renal dysfunction was defined as creatinine

clearance (estimated using the Cockcroft algorithm) <60 mL/minute and severe renal dysfunction as creatinine clearance <30 mL/minute [26]. Tumor sites were classified as follows: colorectal, breast, upper gastrointestinal tract and liver, prostate, urinary tract, and other.

At baseline, each patient underwent a CGA, as described in detail previously [27]. Briefly, the CGA uses validated tests and scores to assess nine domains, according to international recommendations [28, 29]: functional status (activities of daily living score [ADL] [30] and Eastern Cooperative Oncology Group performance status [ECOG-PS] [31]), mobility (timed get-up-and-go test and walking impairments [32]), nutritional status (Mini-Nutritional Assessment [MNA] [33]), cognitive status (Mini-Mental State Examination [MMSE]) [34], mood (Mini-Geriatric Depression Scale [mini-GDS] [35]), comorbidities (Cumulative Illness Rating Scale for Geriatrics [CIRS-G] [36]), polypharmacy (number of medications), social environment, and urinary and/or fecal incontinence. The social environment was evaluated based on marital status, use of homemaker services, and whether the patient lived alone. Polypharmacy was defined as the intake of five or more medications per day. After the geriatric oncology visit, a multidisciplinary meeting was held for each patient to plan the cancer treatment strategy.

Outcomes

The primary endpoint was feasibility of the planned cancer treatment, which was assessed prospectively using three separate data sources, namely, the paper and hospital electronic medical charts (MediWeb version 4.0, DIH-CHU Henri-Mondor, Créteil, France) and the hospital chemotherapy database (CHIMIO version 2.0). Each chemotherapy drug given during each cycle (name and dose) is recorded routinely and validated by the pharmacist in charge at the time of chemotherapy delivery in the oncology department. Reasons for nonfeasibility were recorded based on the medical charts. Chemotherapy toxicities were classified using Common Terminology Criteria for Adverse Events version 4.0 [37].

The cancer treatment plan was defined as the full treatment strategy chosen for each individual patient during the multidisciplinary meeting, based on tumor site and metastatic status. This strategy included one or more of the following modalities: chemotherapy, surgery, radiotherapy, and hormonal therapy. We assessed feasibility of the overall cancer treatment plan and each of its components.

Feasibility of surgery was defined as successful performance of the planned surgical procedure without mortality within the next 30 days [38]. For radiotherapy and hormonal therapy, feasibility was delivery of the initially planned dose selected during the multidisciplinary meeting. Chemotherapy feasibility was delivery of the planned number of cycles determined based on tumor site and metastatic status. The optimal duration of chemotherapy remains unclear [39, 40]. During the multidisciplinary meetings, the number of cycles selected was the number of cycles in standard chemotherapy regimens used in clinical practice in accordance with French guidelines [41]: at least 12 cycles for colorectal cancer [19] and at least 4 cycles for other tumor sites [22] in patients without metastases and at least 6 cycles for colorectal cancer and 3 cycles for other tumor sites in patients with metastases.

Figure 1. Patient flowchart for the ELCAPA-03 study. Data on treatment feasibility were available for 385 of the 421 patients eligible for recruitment into the ELCAPA cohort.

^aSome patients received two or more treatment modalities and the sum of the patients in the four modality groups is therefore greater than 421.

^bSome patients had missing data for two or more treatment feasibility.

For each patient, treatment feasibility was adjudicated by a panel of experts (two oncologists [S.C., C.T.], one radiation therapist [J.L.L.], one geriatrician [E.P.], and one pharmacist [M.C.V.]).

Overall 1-year mortality was recorded based on both the hospital medical charts and the public records office of each patient's place of birth.

Statistical Analysis

Patient characteristics are described as number (percentage) for qualitative data and mean (± 1 SD) or median (25th–75th percentile) for quantitative data. Baseline characteristics of study patients and patients lost to follow-up before the feasibility assessment were compared using the chi-square test, Fisher's exact test, or nonparametric Mann-Whitney test, as appropriate.

Rate of Treatment Feasibility

Treatment feasibility rates were calculated with their 95% confidence intervals (CIs) estimated using normal or binomial distributions, as appropriate. The objective of cancer treatment could differ between patients with and without metastases; therefore, we evaluated these two groups separately.

In the subgroup of patients with metastases who were scheduled for chemotherapy, we conducted a sensitivity analysis by excluding patients with disease progression or refusal to continue chemotherapy [42].

CGA-Associated Factors

We conducted univariate and multivariate analyses to identify factors associated with treatment feasibility. Univariate analyses relied on the chi-square test or Fisher's exact test for qualitative variables and the *t* test or nonparametric Wilcoxon-Mann-Whitney test for quantitative variables. Variables yielding *p* values $< .15$ by univariate analysis were entered into a multivariate logistic regression model. Adjusted odds ratios (ORs) with their 95% CIs were estimated. To ensure consistency with the descriptive analysis performed separately in the groups with and without metastases, we added an interaction term between metastatic status and variables reflecting general health (ECOG-PS, ADL, and mobility).

We did not perform multiple imputations for missing data. All tests were two-tailed. The *p* values $< .05$ were considered statistically significant. The data were analyzed using Stata statistical software version 11.0 (StataCorp, College Station, TX, <http://www.stata.com>).

RESULTS

Data on treatment feasibility were available for 385 of the 421 eligible patients (Fig. 1). Compared with the study patients, patients lost to follow-up for the feasibility assessment ($n = 36$, 8.6%) were older and had worse functional status (mean age: 82.5 ± 4.9 years vs. 78.9 ± 5.4 years, $p < .001$; median ADL: 5.7 [range: 3.5–6] vs. 6 [range: 5.5–6], $p < .001$).

Table 1. Demographic and clinical characteristics of the 385 ELCAPA-03 patients included in the treatment feasibility assessment

Characteristic	Result
Age in years, mean $\pm$ SD	78.9 $\pm$ 5.4
Male gender, <i>n</i> (%)	184 (47.8)
Tumor site, <i>n</i> (%)	
Colorectal	110 (28.6)
Breast	89 (23.1)
Upper gastrointestinal and liver ^a	74 (19.2)
Urinary tract ^b	51 (13.2)
Prostate	42 (10.9)
Other ^c	19 (4.9)
Metastatic disease (<i>n</i> = 385), ^d <i>n</i> (%)	181 (47.0)
CGA parameters	
Living alone (<i>n</i> = 385), ^d <i>n</i> (%)	139 (36.1)
Not living with a spouse or partner (<i>n</i> = 385), ^d <i>n</i> (%)	178 (46.2)
Homemaker services (<i>n</i> = 382), ^d <i>n</i> (%)	118 (30.9)
ECOG PS ≥ 2 (<i>n</i> = 385), ^d <i>n</i> (%)	155 (40.2)
ADL score (<i>n</i> = 385), ^d median (IQR)	6 (5.5–6)
ADL ≤ 5 (<i>n</i> = 385), ^d <i>n</i> (%)	81 (21.0)
Walking problems (<i>n</i> = 385), ^d <i>n</i> (%)	133 (34.5)
High fall risk ^e (<i>n</i> = 377), ^d <i>n</i> (%)	178 (47.2)
MMSE (<i>n</i> = 317), ^d median (IQR)	28 (26–29)
MMSE $< 24/30$ (<i>n</i> = 317), ^d <i>n</i> (%)	39 (12.3)
Mini GDS ≥ 1 (<i>n</i> = 383), ^d <i>n</i> (%)	107 (27.9)
MNA (<i>n</i> = 361), ^d median (IQR)	23 (19.5–25.5)
MNA ≤ 23.5 (<i>n</i> = 361), ^d <i>n</i> (%)	151 (41.8)
Urinary and/or fecal incontinence (<i>n</i> = 385), ^d <i>n</i> (%)	23 (6.0)
Number of drugs (<i>n</i> = 382), ^d median (IQR)	5 (3–8)
CIRS-G (<i>n</i> = 316), ^d median (IQR)	14 (11–17)
Creatinine clearance, Cockcroft, mL/min (<i>n</i> = 345), ^d median (IQR)	54 (41.3–70.5)
Albumin (g/L) (<i>n</i> = 268), ^d median (IQR)	36.0 (30.3–41)
CRP (mg/L) (<i>n</i> = 207), ^d median (IQR)	8.5 (4.8–37)

^aStomach, pancreas, biliary tract, and liver were in this category.^bProstate, kidney, urinary bladder, and urinary tract were in this category.^cOvary, uterus, skin, lung, head and neck, and unknown primary were in this category.^dNumber of patients for whom data were available.^edefined as a timed get-up-and-go > 20 seconds and/or one-leg standing balance test < 5 seconds on one or both lower limbs.

Abbreviations: ADL, activities of daily living; CGA, Comprehensive Geriatric Assessment; CIRS-G, Cumulative Illness Rating Scale for Geriatrics; CRP, C-reactive protein; ECOG PS, Eastern Cooperative Oncology Group Performance Status; IQR, interquartile range, Q1–Q3; MMSE, Mini-Mental State Evaluation; mini-GDS, mini-Geriatric Depression Scale; MNA, Mini-Nutritional Assessment.

Table 1 lists the main baseline characteristics of the 385 patients, most of whom had no functional impairments (79% with ADL > 5) or cognitive impairments (87.7% with MMSE ≥ 24 of 30). The most common comorbidities were renal dysfunction (*n* = 208, 54.0%), which was severe in 28 patients (13.5%); hypertension (*n* = 240, 62.3%); and diabetes mellitus (*n* = 83, 21.6%). A total of 15 different cancer treatment plans

were identified (Table 2). Chemotherapy was scheduled for 220 patients, alone in 143 (65%) and combined with another treatment in 77 (35%). Among the 220 patients given chemotherapy, 9 received targeted therapies, which were used alone in 5 patients and combined in 4 patients. Median follow-up was 13.4 months (range: 5.3–24.6). Overall 1-year mortality was 11.3% (23 patients) in the group without metastases and 42.0% (76 patients) in the group with metastases.

The overall feasibility rate was 86.8% (95% CI: 82.1–91.5) in the group without metastases and 65.7% (95% CI: 58.8–72.7) in the group with metastases. The majority of patients with either failure to start or early discontinuation of cancer treatment had chemotherapy scheduled: 21 in the group without metastases (alone in 7 and combined in 14 patients) and 58 in the group with metastases (alone in 47 and combined in 11). Table 3 reports the feasibility rates for each treatment modality, and Table 4 reports the reasons for failure to start or early discontinuation of cancer treatment. Among the nine patients who died before beginning chemotherapy, all had metastases and seven were scheduled to receive chemotherapy alone; five had pancreatic cancer with intestinal obstruction and scheduled gemcitabine chemotherapy but experienced a fast decline in general health; three (colon, prostate, and stomach cancer, respectively) had major functional impairment at baseline (ECOG-PS 3 or 4); and one died of complications after surgery for colorectal cancer.

Few patients failed to receive scheduled surgery, radiotherapy, and/or hormonal therapy. Consequently, we report the results of the univariate and multivariate analyses of associations linking CGA parameters to chemotherapy feasibility. By univariate analysis, factors associated with chemotherapy feasibility at $p < .15$ were younger age (mean: 77.2 $\pm$ 4.4 years when feasible vs. 78.6 $\pm$ 4.5 years when not feasible; $p = .04$), female gender (52.8% vs. 42.5%; $p = .14$), non-metastatic disease (39.3% vs. 26.2%; $p = .05$), living with a partner (61.1% vs. 47.5% $p = .05$), ECOG-PS < 2 (66.4% vs. 36.2%; $p < .0001$) or ADL > 5 (87.1% vs. 67.5%; $p < .001$), absence of difficulty walking (76.4% vs. 51.9%; $p < .0001$) or absence of fall risk (64.8% vs. 41%; $p = .001$), absence of depressive mood defined as mini-GDS < 1 (75.6% vs. 63.9%; $p = .08$), higher MMSE (median: 28 [range: 27–30] vs. 27 [range: 26–29]; $p = .05$), higher MNA (median: 22.7 [range: 19.5–25] vs. 20.5 [range: 15.5–24.5]; $p = .001$), lower comorbidity index as assessed by the CIRS-G (median: 13 [range: 11–16] vs. 15 [range: 13–17]; $p = .05$), higher creatinine clearance (median: 59.5 mL/minute [range: 45.7–78.1 mL/minute] vs. 52.5 mL/min [range: 41.3–66.8 mL/minute]; $p = .001$), and higher serum albumin (35.4 g/L [range: 30.7–40.2 g/L] vs. 32.7 g/L [range: 27.6–37 g/L]; $p = .03$). The concomitant use of surgery (20.7% when chemotherapy was feasible vs. 17.5% when not feasible; $p = .56$) or hormonal therapy (8.7% vs. 7.5%; $p = .78$) or radiotherapy (20.7% vs. 25.6%; $p = .4$) was not associated with chemotherapy feasibility.

Albumin was not entered into the multivariate analysis because of the large number of missing data (79 patients [35.9%]). Colinearity precluded simultaneous entry into the same multivariate model of both measures of functional status (ECOG-PS and ADL) or mobility (walking difficulties and fall risk). By multivariate analysis, factors independently associated with

Table 2. Cancer treatment plans

Planned treatment (n = 385)	Patients without metastases (n = 204), n (%)	Patients with metastases (n = 181), n (%)
Surgery alone	59 (28.9)	8 (4.4)
Plus chemotherapy	15 (7.3)	9 (5)
Plus chemotherapy plus RT	8 (3.9)	2 (1.1)
Plus chemotherapy plus RT plus HT	6 (2.9)	2 (1.1)
Plus HT	7 (3.4)	0 (0)
Plus RT plus HT	10 (4.9)	0 (0)
Plus chemotherapy plus HT	1 (0.5)	0 (0)
Plus RT	10 (4.9)	2 (1.1)
Chemotherapy alone	32 (15.7)	111 (61.3)
Plus RT	13 (6.3)	12 (6.6)
Plus RT and HT	1 (0.5)	5 (2.8)
Plus HT	0 (0)	3 (1.7)
RT alone	20 (9.8)	10 (5.5)
Plus HT	16 (7.8)	4 (2.2)
HT alone	6 (2.9)	13 (7.2)

Abbreviations: HT, hormonal therapy; RT; radiotherapy.

Table 3. Rates of cancer treatment feasibility in the ELCAPA-03 study

Treatment	Patients without metastases (n = 204), n (%) [95% CI]	Patients with metastases (n = 181), n (%) [95% CI]
Overall treatment plan ^a	177/204 (86.8) [82.1–91.5]	119/181 (65.7) [58.8–72.7]
Surgery ^b	111/116 (0.95.7) [90.3–98.6]	19/23 (82.6) [61.2–95.1]
Chemotherapy ^b	55/76 (72.4) [62.1–82.6]	85/144 (59.0) [50.9–67.1]
Hormonal therapy ^b	46/47 (97.9) [88.7–100]	23/27 (85.2) [66.3–95.9]
Radiotherapy ^b	81/84 (96.4) [90–100]	37/37

^aAll components of the cancer treatment selected during a multidisciplinary meeting (see Table 2)

^bSome patients were scheduled to receive two or more treatment modalities and the sum of the patients in the four treatment-modality groups is therefore greater than 385.

Abbreviation: CI, confidence interval.

chemotherapy feasibility were ECOG-PS <2 (adjusted OR [aOR]: 4.0; 95% CI: 1.87–8.7; $p < .0001$) or ADL >5 (aOR: 3.01; 95% CI: 1.28–7.09; $p = .01$) or absence of walking difficulties (aOR: 2.7; 95% CI: 1.25–5.85; $p = .01$) or absence of fall risk (aOR: 2.85; 95% CI: 1.33–6.08; $p = .007$) and higher creatinine clearance (aOR_{1 mL/minute}: 1.3; 95% CI: 1.01–1.7; $p = .04$). Nonmetastatic disease and higher MNA showed associations of borderline significance with chemotherapy feasibility (non-metastatic vs. metastatic [aOR: 2.45; 95% CI: 0.88–6.8; $p = .08$] and [aOR_{1 point increase}: 1.07; 95% CI: 0.99–1.15; $p = .08$], respectively). Associations with age, CIRS-G, mini-GDS, and MMSE were no longer significant after adjustment for measures of functional status or mobility limitations.

In the patients with metastases, 1-year mortality was 27.7% in the group with overall feasibility and 56.4% in the group with overall treatment failure ($p < .0001$). In the patients without metastases, corresponding 1-year mortality rates were 10.2% and 14.8%, respectively ($p = .47$).

Sensitivity Analysis

When patients with disease progression or refusal to continue chemotherapy were excluded from the subgroup with metastatic disease, the chemotherapy feasibility rate increased slightly to 61.1% (95% CI: 52.9%–69.3%).

DISCUSSION

Planned cancer treatment was feasible in 86.8% of patients without metastases and 65.8% of those with metastases. The feasibility rate was lowest in the patients scheduled for chemotherapy. The main reasons for either failure to start chemotherapy or early discontinuation of chemotherapy were toxicities, an early decline in general health, and death. Conversely, surgery, hormonal therapy, and radiotherapy were usually feasible in everyday practice in older cancer patients: Feasibility rates for these modalities were more than 95% in the group without metastases and ranged from 82.6% to 100% in the group with metastases. Functional status (ECOG-PS or ADL), mobility (walking difficulties or fall risk), and renal function were independently associated with chemotherapy feasibility. Metastasis and nutritional status were of borderline significance.

At baseline, age and geriatric syndromes (most notably functional and cognitive impairments) in our study patients were comparable to those reported in other surveys of older cancer patients using CGA [43, 44]. Chemotherapy feasibility rates were consistent with previous studies, which ranged from 49.1% [19, 20, 23, 43, 45–48] to 80% [49]. The highest feasibility rates were found in studies [19, 20, 49] that included only patients without metastases, whose functional status was probably better than in our population.

Table 4. Reasons for either failure to start or early discontinuation of cancer treatment in the ELCAPA-03 patients

Planned treatment (N1/N2)	Patients without metastases (n = 204)	Patients with metastases (n = 181)
Surgery (116/23)	Patient refusal (n = 3), died within 30 days of surgery (n = 2)	Patient refusal (n = 1), decline in general health (n = 1), died within 30 days of surgery (n = 2)
Chemotherapy (76/144)	Received none of the planned cycles (n = 8): patient refusal (n = 4), unknown (n = 4) Received some of the planned cycles (n = 13): gastrointestinal toxicity grade III ^b (n = 7), disease stabilization (n = 1), decline in general health ^c (n = 1), unknown (n = 4)	Received none of the planned cycles (n = 24): patient refusal (n = 5), decline in general health (n = 6), death ^a (n = 9), unknown (n = 4) Received some of the planned cycles (n = 35): patient refusal (n = 1), gastrointestinal toxicity grade III ^b (n = 9), disease progression (n = 4), death (n = 5), decline in general health (n = 8), unknown (n = 8)
Hormonal therapy (48/23)	Local disease progression (n = 1)	Death (n = 1), disease progression (n = 2), patient refusal (n = 1)
Radiotherapy (90/31)	Patient refusal (n = 2), toxicity (n = 1)	

^aWithin 1 month after study inclusion.^bDiarrhea.^cSecondary to a fracture of the humerus.

Abbreviations: N1, number among patients without metastasis; N2, number among patients with metastasis.

Whether feasibility is more common in younger versus older cancer patients seen in everyday practice remains unclear. Experimental data suggest similar feasibility rates across age groups [4–9]. In one study, feasibility rates in middle-aged patients with colorectal cancer were similar to those in our study [48], whereas two observational studies found lower feasibility rates in older cancer patients than in middle-aged cancer patients [20, 23]. Importantly, most of these studies failed to correct for confounding factors such as functional status and competing comorbidities. We found that functional impairment (ECOG-PS or ADL alterations) or mobility limitations (walking difficulties or fall risk) were confounding factors for the association between age and chemotherapy feasibility. In two studies of functional status in patients with ovarian carcinoma [50] or with breast, lung, or colorectal cancer [43], functional status was associated with chemotherapy feasibility. To our knowledge, the association between renal dysfunction and chemotherapy feasibility has not been reported previously.

Only two studies concomitantly assessed the feasibility rates of chemotherapy and radiotherapy [21, 51]. Both were small sample studies (n = 41 and n = 36, respectively) in patients with rectal cancer and found very high radiotherapy feasibility rates, contrasting with a 77% rate of chemotherapy feasibility [21].

Definitions of feasibility vary widely, particularly for surgery and chemotherapy [19, 20, 23, 24, 43, 45–48]. Surgery feasibility has been defined as successful completion of the planned surgical procedure, tumor-free resection margins, or absence of postoperative complications with survival on day 30. In one study, surgery failure, defined as death by day 30, was only 3.5% [38]. The chemotherapy feasibility criteria used to date include various measures: dosage reduction [24, 52], cycle number reduction, wider spacing of cycles [52], or a combined endpoint [43] including all-cause mortality and/or grade III or IV toxicity [24, 43] and/or treatment interruption and/or admission during chemotherapy [24].

This study has a number of strengths. To the best of our knowledge, it reports the first data on feasibility of each individual treatment modality in older cancer patients. Patient

recruitment, follow-up, and data collection were conducted prospectively using a standardized case-report form and database. Very few patients were lost to follow-up. The feasibility measures were relevant to tumor site and metastases and were assessed using objective quantitative criteria (number of chemotherapy cycles, radiation dose, or hormonal therapy dose). In addition, data on feasibility were obtained from three sources (paper and electronic hospital medical charts and hospital chemotherapy database) to limit misclassification bias. In a previous study, sensitivity and specificity of Medicare claims for identifying chemotherapy cycles were lower than those of medical record review [53].

Our study has several limitations. First, patient recruitment at two teaching hospitals led to selection bias. In a study of patients with ovarian cancer, a higher proportion of patients received the full chemotherapy course in a teaching hospital than in a nonteaching hospital [54]. Second, approximately 60% of older cancer patients in the study teaching hospitals were referred to the geriatric oncology clinics [27]. Consequently, our results may not apply to the overall population of older patients with solid cancer. Our population included patients with a wide variety of tumor sites. Finally, the number of patients was too small for a robust analysis of factors associated with chemotherapy feasibility in the subgroups with and without metastasis; however, the interaction term between metastasis and functional status enabled us to assess these factors and to take into account the differences between the groups with and without metastasis.

Clinical Implications

Given the growing number of older patients with cancer, the limited number of geriatricians, and the time-consuming nature of the CGA (1–2 hours per patient), our results suggest that, among older cancer patients, those initially considered for chemotherapy by the oncologist or other specialist may benefit the most from referral to a geriatric oncology clinic before the final treatment decision.

Recent studies in patients with advanced colorectal cancer (stage III or IV) indicated that cognitive and functional impairments, depressive mood, and hypoalbuminemia were

independently associated with treatment failure [24, 55, 56]. Further studies are needed to confirm the independent association of these factors with chemotherapy failure in patients with tumors at other sites and to determine whether geriatric follow-up targeting these factors improves treatment feasibility, overall survival, and quality of life.

CONCLUSION

Our data from everyday practice showed that planned cancer treatment was feasible in 86.8% of older cancer patients without metastases and 65.7% of those with metastases. Feasibility rates were considerably lower for chemotherapy than for surgery, radiotherapy, and hormonal therapy. Consequently, utilization of limited geriatric oncology resources may be optimized by the preferential referral of older cancer patients initially considered for chemotherapy to geriatric oncology clinics [57].

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AUTHOR CONTRIBUTIONS

Conception/Design: Florence Canoui-Poittrine, Marie Laurent, Elena Paillaud, Philippe Caillet, Aurélie Le Thuaut, Sylvie Bastuji-Garin

Provision of study material or patients: Florence Canoui-Poittrine, Marie Laurent, Elena Paillaud, Christophe Tournigand, Philippe Caillet, Jean-Léon Lagrange, Stéphane Culine, Hélène Vincent, Muriel Carvalho-Verlinde

Collection and/or assembly of data: Florence Canoui-Poittrine, Marie Laurent, Elena Paillaud, Philippe Caillet, Aurélie Le Thuaut, Sylvie Bastuji-Garin, Muriel Carvalho-Verlinde

Data analysis and interpretation: Florence Canoui-Poittrine, Marie Laurent, Elena Paillaud, Aurélie Le Thuaut, Sylvie Bastuji-Garin

Manuscript writing: Florence Canoui-Poittrine, Marie Laurent, Elena Paillaud, Christophe Tournigand, Philippe Caillet, Aurélie Le Thuaut, Jean-Léon Lagrange, Olivier Beauchet, Hélène Vincent, Muriel Carvalho-Verlinde, Stéphane Culine, Sylvie Bastuji-Garin

Final approval of manuscript: Florence Canoui-Poittrine, Marie Laurent, Elena Paillaud, Christophe Tournigand, Philippe Caillet, Aurélie Le Thuaut, Jean-Léon Lagrange, Olivier Beauchet, Hélène Vincent, Muriel Carvalho-Verlinde, Stéphane Culine, Sylvie Bastuji-Garin

DISCLOSURES

Jean-Léon Lagrange: INSERM (RF). The other authors indicated no financial relationships.

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