Surgery and Adjuvant Chemotherapy Use Among Veterans With Colon Cancer: Insights From a California Study

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ABSTRACT

Purpose

US veterans have been shown to be a vulnerable population with high cancer rates, and cancer care quality in Veterans Affairs (VA) hospitals is the focus of a congressionally mandated review. We examined rates of surgery and chemotherapy use among veterans with colon cancer at VA and non-VA facilities in California to gain insight into factors associated with quality of cancer care.

Methods

A retrospective cohort of incident colon cancer patients from the California Cancer Registry, who were ≥ 66 years old and eligible to use VA and Medicare between 1999 and 2001, were observed for 6 months after diagnosis.

Results

Among 601 veterans with colon cancer, 72% were initially diagnosed and treated in non-VA facilities. Among veterans with stage I to III cancer, those diagnosed and initially treated in VA facilities experienced similar colectomy rates as those at non-VA facilities. Stage III patients diagnosed and initially treated in VA versus non-VA facilities had similar odds of receiving adjuvant chemotherapy. In both settings, older patients had lower odds of receiving chemotherapy than their younger counterparts even when race and comorbidity were considered (age 76 to 85 years: odds ratio [OR] = 0.18; 95% CI, 0.07 to 0.46; age ≥ 86 years: OR = 0.17; 95% CI, 0.04 to 0.73).

Conclusion

In California, older veterans with colon cancer used both VA and non-VA facilities for cancer treatment, and odds of receiving cancer-directed surgery and chemotherapy were similar in both systems. Among stage III patients, older age lowered odds of receiving adjuvant chemotherapy in both systems. Further studies should continue to explore potential health system effects on quality of colon cancer care across the United States.

J Clin Oncol 28:2571-2576. © 2010 by American Society of Clinical Oncology

INTRODUCTION

More than 108,000 new colon cancers were diagnosed in the United States in 2008.¹ Five-year relative survival rates for colon cancer are low at 65%, partly reflecting low rates of screening¹ and suboptimal use of recommended therapies.^{2,3} For patients with cancer receiving care from the Department of Veterans Affairs (VA) health care system, concern has been raised about whether the estimated 175,000 patients with cancer treated each year⁴ are receiving appropriate cancer care. Furthermore, VA cancer care is the focus of a congressionally mandated Government Performance and Results Act study. Measurement of cancer care and outcomes in the VA population is complicated by veterans' use of both VA and non-VA health care.^{5,6} This dual use occurs particularly among elderly VA patients, most of whom are also enrolled in Medicare. Little is known

about the characteristics of veterans with colon cancer who choose one system over the other or the effects of that choice on treatment patterns or outcomes. Moreover, questions remain about whether veterans have unique characteristics that make them more at risk for diagnosis at later stages of disease and whether they receive comparable care in VA and non-VA settings. Multiple studies have demonstrated the association of nonclinical characteristics such as age, race, and health care coverage with likelihood of receiving guideline-consistent care, including surgery and adjuvant chemotherapy for colon cancer, even when clinical characteristics such as stage and comorbidities are taken into account.^{2,3,7,8}

As has been noted in recent reviews, over the last 10 years, several studies of chronic disease treatment have shown that the VA is performing better than other health care systems in some preventive

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Submitted April 8, 2009; accepted February 1, 2010; published online ahead of print at www.jco.org on April 20, 2010.

Supported by the Department of Veterans Affairs (VA), Health Services Research and Development Service Project No. IIR 03-196, "Quality and Costs of Colon Cancer Care in VA and Medicare" and Project No. SDR 02-237 "VA CMS Data for Research" (principal investigator, D.M.H.). Also supported by a VA Health Services Research and Development Service Research Career Scientist Award (D.M.H.). The collection of the California cancer incidence data used in this study was supported by the California Department of Public Health and by the Northern California Cancer Center under contract from the National Cancer Institute's Surveillance, Epidemiology, and End Results Program.

Presented in part at the 43rd Annual Meeting of the American Society of Clinical Oncology Annual Meeting, June 1-5, 2007, Chicago, IL.

The views expressed in this article are those of the authors and do not necessarily represent the views of the Department of Veterans Affairs or the National Cancer Institute's Surveillance, Epidemiology, and End Results Program.

Authors' disclosures of potential conflicts of interest and author contributions are found at the end of this article.

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0732-183X/10/2815-2571/\$20.00

DOI: 10.1200/JCO.2009.23.5200

care and chronic disease management performance measures.^{9,10} Although there has been increased focus on the quality of colon cancer screening and recent efforts to improve treatment,¹⁰ there has been limited work reported about the quality of colon cancer care provided to veterans.

To address these information gaps, we conducted a retrospective cohort study of elderly veterans in California who were diagnosed with colon cancer within and outside of the VA system. We focused on the 6 months after diagnosis to describe colon cancer treatment patterns and to identify factors associated with surgery and adjuvant chemotherapy.

METHODS

Study Design

We assembled a retrospective cohort of elderly veterans diagnosed with stage I to IV colon cancer between 1999 and 2001 and examined their health care use and outcomes over the subsequent 3-year period using VA, Medicare, and National Cancer Institute Surveillance, Epidemiology, and End Results (SEER) California cancer registry data. Our protocol was approved by the Edward Hines, Jr. VA Hospital Institutional Review Board; informed consent was waived. Our study cohort (Fig 1) was identified from a sampling frame of all VA eligible patients in 1999 to 2001 and described elsewhere.^{5,11}

Briefly, the sampling frame comprised all elderly veterans who were known to the VA (ie, they had either used VA health care services, had enrolled for VA health care, or had received compensation or pension benefits from the VA)^{5,11} and were enrolled in Medicare from 1999 to 2001. We matched the California cancer registry data to our sampling frame using a deterministic matching procedure and applied specific criteria for stage I to IV colon cancer diagnosed between July 1, 1999 and December 31, 2001 and age ≥ 66 years at the time of diagnosis, yielding 1,179 veterans. (Details of the matching procedure are available on request from the authors.)

Furthermore, we excluded individuals for whom we had no or incomplete health care utilization data as a result of Medicare health maintenance organization enrollment, non-Medicare primary payer coverage, Part B Medicare coverage only, VA eligibility starting after the beginning of the accrual period, autopsy-only diagnosis, or other unknown reasons. Because the California VA hospitals reported all their new cancer cases to the California registry as well as the VA Central Cancer Registry, we were able to identify patients who were diagnosed and initially treated in VA and non-VA hospitals using the California registry and then validate them with matching to the VA Central Cancer Registry. The resulting analytic cohort comprised 166 VA patients and 435 non-VA patients, for a total of 601 patients with stage I to IV colon cancer.

Data Sources

We obtained data from multiple sources to ascertain each patient's cancer characteristics, health care utilization, comorbidities, demographic and enrollment information, vital status, and geographic characteristics (Table 1). Cancer clinical information, obtained from the California cancer registry, included dates of diagnosis and staging determinants. Information on health care utilization, including surgery dates, and comorbidities was obtained from VA inpatient and outpatient health care utilization databases¹² and Medicare claims for a period beginning 6 months before diagnosis. Patient demographic characteristics included sex, date of birth, race, and ethnicity and were obtained from VA administrative data, Medicare enrollment files, and the cancer registries. Vital status, including date of death, was determined from VA Beneficiary Identification Records Locator System data and Medicare vital status records.

Measures

In patients for whom information on a particular characteristic was available from more than one source (eg, date of birth), decisions regarding

Fig 1. California colon cancer study cohort Department of Veterans Affairs (VA) Central Cancer Registry (VACCR). VIREC, Veterans Affairs Information Resource Center; VHA, Veterans Health Administration; SEER, Surveillance, Epidemiology, and End Results; HMO, health maintenance organization.

which source to use were based on the following two criteria: whether the source provided information for both the VA and non-VA patients and assessments of the validity and completeness of the data element from each source, based on prior studies and publicly available reports.^{5,11,13-15}

Cancer stage at diagnosis was determined using information from the VA and California SEER registries and using the American Joint Committee on Cancer fifth edition staging schema.¹⁶ We ascertained whether or not the patient had undergone a colectomy and date of surgery from Medicare claims and VA utilization data using Current Procedural Terminology, Fourth Edition, and International Classification of Diseases, Ninth Revision, procedure codes (Appendix Table A1, online only). If we were unable to find a colectomy record within 6 months of the diagnosis date in either the VA or Medicare data, we searched for evidence of surgery in the cancer registry data. We identified the first surgery to occur between 1 month before and 6 months after diagnosis as the index surgery. Whether or not the patient had received chemotherapy as part of the first course of treatment was determined from Medicare claims and VA utilization and pharmacy records using procedure and other administrative codes and drug names (Appendix Table A2, online only). We searched for the first record of chemotherapy received after and within 6 months of the index surgery date. To assign a chemotherapy status to as many patients as

Table 1. Study Measures and Data Sources

Measure and Data Source	Administrative Codes	Definition
Adjuvant chemotherapy receipt		Coded yes or no; stage III patients only; postcolectomy only and alive within 1 month of colectomy; based on occurrence of code with date of service within 6 months of colectomy date
Medicare	ICD-9 diagnosis and procedure, CPT-4, HCPCS, BETOS, Revenue Center	
VA	ICD-9, CPT-4, Clinic Stop, VA Drug Class	
Cancer stage		AJCC fifth edition schema
Cancer registry	NA	
Colectomy		Coded yes or no; stage I-III patients only; based on occurrence of code for colectomy (Appendix Table A1) occurring between 1 month before and 6 months after diagnosis date
Medicare	ICD-9, CPT-4	
VA	ICD-9, CPT-4	
Cancer registry	Site-specific cancer-directed surgical codes	
Comorbidity Score		Deyo-Charlson index with Romano adaptations; based on data from 6 mo before to 6 mo after cancer diagnosis date; excludes comorbid cancers; categorized as 0, 1, 2, 3, or ≥ 4
Medicare	ICD-9 diagnosis and procedure, HCPCS	
VA	ICD-9 diagnosis and procedure, CPT-4	
Initial diagnosis and treatment system of care		Categorized as VA or non-VA group; reporting facility for where patient was diagnosed and/or received initial treatment
VACCR	NA	
SEER	NA	
Age, race, and sex		Age at diagnosis calculated from date of birth in Medicare vital status file; race categorized as non-Hispanic white, non-Hispanic African American, or other race
Medicare	NA	
Marital status		Marital status obtained from cancer registry or, when missing, from VA utilization data
Cancer registry, VA	NA	
Distance to VA facility		Straight-line distance in miles between the health care facility and the centroid of the zip code of the patient's residence
VA	NA	
Veterans Integrated Services Network		Department of Veterans Affairs geographic regions No. 1-23
VA	NA	

Abbreviations: ICD-9, International Classification of Diseases, Ninth Revision; CPT-4, Current Procedural Terminology, Fourth Edition; HCPCS, Health Care Common Procedure Coding System; BETOS, Berenson-Eggers Type of Service code; VA, Department of Veterans Affairs; NA, not applicable; AJCC, American Joint Committee on Cancer; VACCR, Veterans Affairs Central Cancer Registry; SEER, Surveillance, Epidemiology, and End Results.

possible, we constructed a decision algorithm to resolve situations of conflicting or incomplete information (available on request).

Comorbidities were assessed using a modified Deyo-Charlson comorbidity index with Romano adaptations.¹⁷⁻¹⁹ International Classification of Diseases, Ninth Revision, Clinical Modification, diagnosis and procedure codes appearing in VA health care utilization records and Medicare claims during the 6 months before and after the colon cancer diagnosis were used to identify the 15 comorbid conditions (Appendix Table A3, online only). To maximize the likelihood that only claims containing a clinician-assigned diagnosis were used, claims from clinical laboratory, diagnostic imaging (e.g., radiology, x-ray), and other types of ancillary tests and durable medical equipment were excluded.²⁰ To prevent overestimation and biased measures of comorbidity, an algorithm was used to screen for codes thought to represent a rule-out diagnosis rather than a definitive diagnosis.²¹ An individual was determined to have a definitive diagnosis based on the following criterion: a diagnostic code for that condition appeared in either an inpatient record or in two or more outpatient records with visit dates that were more than 30 days apart. We excluded comorbid cancers from the comorbidity index calculation.

Demographic data (age, race, and sex) were obtained from Medicare's vital status files. Marital status was obtained from the cancer registry or VA data. Geographic distance to a VA facility was calculated based on latitude and longitude of the health care facility and that of the centroid of the zip code of

the patient's residence. The VA region known as the VA Integrated Service Network was obtained from date of last contact with the VA.

Finally, we classified patients based on whether they had been reported to the California SEER registry by a VA or non-VA facility. Patients reported by VA facilities (those diagnosed at and/or receiving their first course of colon cancer treatment in the VA) are classified as being in the VA group.

Analysis

We determined rates of colectomy, by stage, and rates of adjuvant chemotherapy receipt among patients, focusing on patients with stage III cancer because clinical guidelines at the time supported adjuvant chemotherapy treatment only for this stage. We evaluated differences in surgery rates across stage using Wilcoxon and χ^2 tests. We used multivariable logistic regression to examine the effects of multiple factors on the receipt of colectomy among patients with stage I to III colon cancer; we also examined the effects of individual factors on the receipt of adjuvant chemotherapy among patients with stage III colon cancer, excluding patients who died within 1 month of surgery. We examined the independent effects of age, race, stage, comorbidity, and initial diagnosis and treating facility on odds of receiving surgery or chemotherapy. We present odds ratios (ORs) and 95% CIs. STATA version 10 (StataCorp, College Station, TX) was used for all analyses.²²

RESULTS

We identified 601 California residents diagnosed with stage I to IV colon cancer between July 1, 1999 and December 31, 2001. Of these, 166 (28%) were patients reported by VA hospitals; that is, these patients were diagnosed and/or received their first course of colon cancer treatment in the VA (VA group). Cohort characteristics, overall and by initial diagnosis and treatment facility (VA group *v* non-VA group), are listed in Table 2. As expected among veterans, a large majority (92%) were male. Twenty percent had metastatic (stage IV) colon cancer at the time of diagnosis, similar to numbers reported elsewhere.²³ Patients diagnosed in VA facilities, compared with the non-VA group, were younger (mean age, 75 *v* 77 years, respectively) and more often male (98% *v* 90%, respectively) and married (48% *v* 34%, respectively). The groups also differed in their race/ethnic composition; the VA group had higher percentages of non-Hispanic African Americans and individuals from other race/ethnic minority groups.

We examined surgery and adjuvant chemotherapy rates for specific stages of colon cancer as dictated by clinical guidelines in place during the period of study. For receipt of colon cancer–directed surgery, we limited our analyses to patients with stage I to III colon cancer. We found that high percentages of patients with stage I (88%), II

(97%), and III (100%) cancer underwent colectomy. Because all stage III patients received surgery, our multivariable analyses focused on patients with stage I and II disease. When adjusted for age at diagnosis, race, stage, comorbidity status, and where patients were diagnosed and initially treated, we found that patients in the VA and non-VA groups had similar odds of receiving colectomy (OR = 0.50; 95% CI, 0.19 to 1.26; results not shown).

For receipt of adjuvant chemotherapy, we limited our analyses to patients with stage III colon cancer and who were alive within 1 month of surgery (*n* = 122). We found that 66% of patients with stage III cancer received adjuvant chemotherapy. Multivariable regression analysis revealed that, when adjusted for race, comorbidity status, and where patients were diagnosed and initially treated, age at diagnosis was a strong predictor of receiving any chemotherapy (Table 3). The odds of receiving adjuvant chemotherapy decreased with increasing age; patients age 76 to 85 years and patients $\geq$ age 86 years had reduced odds of receiving adjuvant chemotherapy compared with their younger counterparts (OR = 0.18; 95% CI, 0.07 to 0.46; OR = 0.17; 95% CI, 0.04 to 0.73, respectively). We also found that the odds of receiving adjuvant chemotherapy were similar for patients in the VA group compared with patients in the non-VA group, adjusting for all other factors (OR = 0.69; 95% CI, 0.26 to 1.87).

Table 2. California Cohort Demographics and Clinical Characteristics by Initial Diagnosis and Treatment System of Care

Characteristic	Total Sample		Non-VA Group		VA Group	
	No. of Patients	%	No. of Patients	%	No. of Patients	%
Total patients	601	100	435	72.4	166	27.6
Male*	554	92.2	392	90.1	162	97.6
Married*	229	38.1	149	34.3	80	48.2
Age at diagnosis, years*						
66-75	254	42.3	166	38.2	88	53.0
76-85	302	50.2	232	53.3	70	42.2
$\geq$ 86	45	7.5	37	8.5	8	4.8
Race/ethnicity*						
Non-Hispanic white	483	80.4	364	83.7	119	71.7
Non-Hispanic African American	48	8.0	27	6.2	21	12.6
Other	70	11.6	44	10.1	26	15.7
Stage at diagnosis						
I	149	24.8	107	24.6	42	25.3
II	197	32.8	149	34.3	48	28.9
III	133	22.1	97	22.3	36	21.7
IV	122	20.3	82	18.8	40	24.1
Comorbidity score						
0	199	33.1	137	31.5	62	37.3
1	161	26.8	112	25.8	49	29.5
2	109	18.1	90	20.7	19	11.5
3	65	10.8	48	11.0	17	10.2
4+	67	11.2	48	11.0	19	11.5
Distance to VA outpatient facility > 10 miles	181	30.1	134	30.8	47	28.3
Distance to VA inpatient facility > 10 miles†	457	76	342	78.6	115	69.3
VISN						
VISN 21: Sierra Pacific Network	295	49.1	213	49.0	82	49.4
VISN 22: Desert Pacific Healthcare Network	279	46.4	209	48.0	70	42.2
Other VISN	27	4.5	13	3.0	14	8.4

Abbreviations: VA, Department of Veterans Affairs; VISN, Veterans Affairs Integrated Service Network.

*Statistically significant at $P \leq .01$.

†Statistically significant at $.01 < P < .05$.

Table 3. Odds of Receiving Chemotherapy Among Colectomy Patients Diagnosed With Stage III Colon Cancer and Alive Within 1 Month of Surgery in California (n = 122)

Characteristic	Odds Ratio	95% CI
Age, years		
66-75	Reference	
76-85	0.18	0.07 to 0.46
≥ 86	0.17	0.04 to 0.73
Race		
Non-Hispanic white	Reference	
Other race	0.54	0.19 to 1.56
Comorbidity score		
0 or 1	Reference	
2+	0.46	0.20 to 1.08
Group		
Non-VA group	Reference	
VA group	0.69	0.26 to 1.87

Abbreviation: VA, Department of Veterans Affairs.

DISCUSSION

We studied characteristics of a cohort of elderly veterans with colon cancer in California. We were particularly interested in ascertaining whether the surgical and medical treatment for colon cancer of veterans whose diagnosis and/or initial treatment occurred in a VA hospital differed in significant ways from the treatment of veterans who received care outside the VA. Specific quality-of-care outcomes were ascertained among stage-appropriate groups.

We found that among the 601 elderly patients with colon cancer in California, patients with stage I to III cancer had high rates of surgery, consistent with recommended guidelines. We found that regardless of whether their initial colon cancer diagnosis and treatment was in a VA or non-VA facility, the odds of receiving colectomy were comparable, adjusted for age, race, stage, and comorbidity status. Similarly, regarding receipt of adjuvant chemotherapy, among patients with stage III colon cancer who had surgery and were alive within 1 month of surgery, the odds were comparable between patients initially diagnosed and treated at VA facilities versus patients initially diagnosed and treated at non-VA facilities, adjusted for age, race, and comorbidity status. Two studies have provided evidence of lower rates of chemotherapy in the VA,^{24,25} whereas Abraham et al²⁶ reported that 71% of patients with stage III colon cancer in their study received recommended therapy including postoperative chemotherapy. Anecdotal evidence suggests that the VA pharmacy tracking systems may be incomplete regarding intravenous medications, and therefore, our rates may be underestimated for VA-treated patients with cancer. However, we used multiple data sources and strategies to identify chemotherapy events, so any potential for underreporting should be minimal. Further explorations about the quality of VA chemotherapy data with larger sample sizes are warranted.

Similar to results found elsewhere and across many cancer sites, we found that veterans with colon cancer in California were less likely to receive chemotherapy as they aged. These age-related declines in chemotherapy were unrelated to differences in stage at diagnosis, comorbidity status, initial diagnosis and treatment facility, and other demographic factors. Research conducted in the 1980s established that chemotherapy had an adjuvant role in the treatment of colon

cancer to lower the risk of recurrence. In their landmark randomized clinical trial of adjuvant fluorouracil (FU) and levamisole after colectomy for treatment of node-positive colon cancer, Moertel et al²⁷ reported a 41% decrease in recurrence rate and, at 3 years, a 33% decrease in mortality. By 1990, the accumulated evidence supporting the benefit of chemotherapy in stage III colon cancer resulted in a National Institutes of Health consensus conference recommendation that treatment of stage III disease should include adjuvant chemotherapy with FU and levamisole.²⁸ Leucovorin has since replaced levamisole in combination with FU for stage III disease.^{29,30} However, the advances in the understanding of the benefits of adjuvant chemotherapy use are not being used to benefit the oldest patients.

Recent efforts in the VA have included nationwide initiatives to improve the quality of colon cancer care, including a focus on improving cancer screening and follow-up.^{8,10} In particular, a current program evaluation underway in the VA and authorized under Public Law 103-62 and 38 USC 527 is focused on cancer care access, quality, and costs provided in the VA. This evaluation is expected to be completed in 2010. This independent evaluation will no doubt be an important source for comparing our results when publically available. VA patients can be assured that quality monitoring and quality improvement efforts focused on cancer care are prominent in the VA health care system priorities.

Our study is limited by the focus on only those veterans known to the VA health care system and excluded patients who had some coverage in health maintenance organizations, yet our results should provide some insight about care provided to veterans in their communities. The study is also limited in that it focuses on the elderly (≥ 66 years) and reflects care in only one state (California), from 8 to 10 years ago (1999 to 2001). However, the evaluation of these retrospective data is within the range of data that are available for such extensive analyses and provides insights for monitoring current colectomy and adjuvant chemotherapy trends. The potential for under-reporting of chemotherapy use among patients treated at VA hospitals may be limited by the fact that multiple data sources for identifying chemotherapy events were used; however, further research should explore other options for chemotherapy ascertainment. Despite these limitations, this study offers a baseline on which more recent efforts for quality improvement in the VA can be gauged.

From these analyses of elderly veterans with colon cancer in California, the rates of receiving cancer-directed surgery were comparable for patients with stage I to III cancer treated at VA and non-VA hospitals, and overall rates of surgery were high for all. Likewise, patients with stage III cancer initially diagnosed and treated in the VA compared with non-VA settings experienced similar odds of receiving adjuvant chemotherapy, consistent with clinical guidelines. Although VA patients can be reassured that care is consistent with recommended guidelines, further research to understand and compare potential health care system effects on the quality of care across the United States are warranted to ensure that public systems such as the VA and Medicare, as well as the private sector, continue to provide high-quality care to our nations' veterans. Among patients with stage III colon cancer, older patients had reduced odds of receiving chemotherapy even when comorbidity status, race, and initial diagnosis and treatment facility were considered. These results are consistent with those of previous studies. Continued efforts focused on exploring and better understanding apparent underuse of adjuvant chemotherapy among older veterans with colon cancer are needed.

AUTHORS' DISCLOSURES OF POTENTIAL CONFLICTS OF INTEREST

The author(s) indicated no potential conflicts of interest.

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