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Urologic Oncology: Seminars and Original Investigations 33 (2015) 267.e31–267.e37

UROLOGIC ONCOLOGY

Original article

Sources of variation in follow-up expenditure after radical cystectomy

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Received 20 August 2014; received in revised form 4 March 2015; accepted 7 March 2015

Abstract

Background: Follow-up care after radical cystectomy is poorly defined, with extensive variation in practice patterns. We sought to determine sources of these variations in care as well as examine the economic effect of standardization of care to guideline-recommended care.

Methods: Using linked Surveillance, Epidemiology, and End Results (SEER)-Medicare data from 1992 to 2007, we determined follow-up care expenditures (time and geography standardized) for 24 months after surgery. Accounted expenditures included office visits, imaging studies, urine tests, and blood work. A multilevel model was implemented to determine the effect of region, surgeon, and patient factors on care delivery. We then compared the actual expenditures on care in the Medicare system (interquartile range) with the expenditures if patients received care recommended by current clinical guidelines.

Results: Expenditures over 24 months of follow-up were calculated per month and per patient. The mean and median total expenditures per patient were $1108 and $805 respectively (minimum $0, maximum $9,805; 25th–75th percentile $344–$1503). Variations in expenditures were most explained at the patient level. After accounting for surgeon and patient levels, we found no regional-level variations in care. Adherence to guidelines would lead to an increase in expenditures by 0.80 to 10.6 times the expenditures exist in current practice.

Conclusion: Although some regional-level and surgeon-level variations in care were found, the most variation in expenditure on follow-up care was at the patient level, largely based on node positivity, chemotherapy status, and final cancer stage. Standardization of care to current established guidelines would create higher expenditures on follow-up care than current practice patterns.

Keywords: Bladder cancer; Cystectomy; Follow-up; Cost analysis; Expenditure

1. Introduction

In 2012, an estimated 73,510 new cases of bladder cancer were diagnosed in the United States, with an estimated 14,880 deaths [1]. For patients with disease not appropriate for conservative forms of intervention, definitive surgery with radical cystectomy remains the standard of care. For the approximately 8,500 patients who receive this surgery each year [2], recurrence and adverse events from urinary tract reconstruction are major concerns [3,4], with most bladder cancer recurrences occurring within the first 2 years after definitive surgery [4,5].

Despite this high risk of recurrence in the first 2 years following invasive therapy, strong evidence to help guide clinicians in the follow-up care of their patients is lacking.

This publication was supported by the Washington University Institute of Clinical and Translational Sciences Grants UL1 TR000448 and KL2 TR000450 from the National Center for Advancing Translational Sciences, USA. The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH.

The Center for Administrative Data Research is supported in part by the Washington University Institute of Clinical and Translational Sciences Grant UL1 TR000448 from the National Center for Advancing Translational Sciences (NCATS) of the National Institutes of Health (NIH), Grant no. R24 HS19455 through the Agency for Healthcare Research and Quality (AHRQ), USA and Grant no. KM1CA156708 through the National Cancer Institute (NCI), USA at the National Institutes of Health (NIH).

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http://dx.doi.org/10.1016/j.urolonc.2015.03.009

In the absence of such evidence, competing guidelines have been proposed. For example, the International Consultation on Urological Diseases offers very broad guidelines for follow-up. They suggest a risk-stratified approach for follow-up without any specific recommendations [6]. In contrast, both the National Comprehensive Cancer Network (NCCN) and the European Association of Urology have published guidelines for follow-up, though both organizations cite a dearth of strong evidence and acknowledge that many of the recommendations are based on expert opinion [7,8]. These guidelines have quite different recommendations on appropriate follow-up after definitive surgery. The lack of agreement in the guidelines, in addition to the weak evidence base, can lead to considerable variation in the follow-up care performed in clinical practice.

To determine mechanisms leading to variation in follow-up care, we performed a population-based study using Surveillance, Epidemiology, and End Results (SEER)-Medicare data. We sought to elucidate whether variations in care were the result of patient, provider, or regional factors. We then determined the consequences on expenditures at the payer level if care were standardized to published guidelines.

2. Materials and methods

2.1. Study population

Using linked SEER-Medicare data from 1992 to 2007, we identified all patients with bladder cancer based on the International Classification of Diseases—Oncology 3 diagnosis codes. Using the National Claims History file (data on physician/supplier part B bills for fee for service Medicare claims from noninstitutional providers), we defined a cohort of patients who underwent surgical excision of their tumor based on the Current Procedural Terminology codes for radical cystectomy. Patients aged 66 to 90 years were included in the study to allow 1 full year of claims for assessment of comorbidity status. Only patients with continuous enrollment in Medicare parts A and B, no health maintenance organization enrollment before surgery, and who survived or were not censored by 1 month after surgery were included in the final study cohort.

2.2. Description of expenditures

We determined follow-up care expenditures for up to 24 months after surgery. This was performed by tallying the expenditures related to office visits, imaging studies, urine tests, and blood work as indexed from the Healthcare Common Procedure Coding System codes (Appendix 1). Ascertainment of care was stopped at death, loss of coverage, health maintenance organization enrollment, or the end of the follow-up in the data.

We calculated the total expenditures on care for each patient, price adjusted for time and geography using the Medicare Economic Index [9]. The distribution of expenditures over a 24-month follow-up period was skewed to the right with 1 mode; therefore, we applied log transformation to each of these variables to better meet the normality assumption of the linear mixed model.

2.3. Statistical analysis

A series of 3-level mixed models with random effects were fit designed to examine the variability of patient expenditures at different levels and how much of the variability could be explained by including patient- and surgeon-specific factors. Patients with a surgeon only appearing once in the data were removed for the multilevel model. There were 11 regions and 384 surgeons with at least 2 patients in the data. Case-wise deletion was used for the missing data based on the complete model. In total, 1,384 patients fit these criteria. The multilevel models were allowed to have unique (random) intercepts by region and surgeon to examine the variability at the region, surgeon, and patient levels. The models differed in the type of factors (fixed effects) that were included. The null model included no factors. The patient model and surgeon model included only patient- or surgeon-specific factors, respectively. The complete model included both patient (age, race, sex, marital status, neighborhood education level, zip code level median income, comorbidity, final stage of the disease [from SEER extent of disease coding], nodal status, whether chemotherapy was administered [neoadjuvant or adjuvant], and hospital readmissions [within 24 mo of surgery]) and surgeon-level factors (presence of a medical school at the hospital where cystectomy was performed, presence of a residency program at the hospital, National Cancer Institute designation of the hospital, employment type of provider [solo, hospital based, or group practice], and the decade of completion of residency of the provider). Deviance tests were performed comparing each model back to its parent.

We then performed an additional analysis to assess the contribution of the individual patient-level factors to the variability in follow-up expenditures. A multilevel modeling framework was implemented with patients nested within surgeons who were subsequently nested into SEER-based geographical regions. We fitted 3-level linear mixed models with random intercepts. Our initial model is a random intercepts model with SEER regions and surgeons nested within SEER regions as random effects and no exploratory variables. We then added in the patient-level factors. We calculated the percentage of total variance in average expenditure explained by each of the individual patient-level factors.

2.4. Medicare expenditures associated with guideline-recommended follow-up care

Table 2 demonstrates the follow-up regimens proposed by the NCCN and the European Association of Urology