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Original article

Validation of Surveillance, Epidemiology, and End Results TNM staging for testicular germ cell tumor

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Abstract

Objectives: To evaluate the accuracy of testicular germ cell tumor category in the Surveillance, Epidemiology, and End Results (SEER) database following the 2010 American Joint Committee of Cancer revision of the TNM staging criteria.

Methods: We performed a retrospective review of our testicular cancer database from January 2010 to July 2011. Registrar extracted data on 76 patients were entered into the Cancer Surveillance Program database from 2 hospitals. We reviewed the SEER coding for each patient, including T, N, M, and S and overall stage group, as well as the range and S value given for tumor markers (lactate dehydrogenase, beta-human chorionic gonadotropin, and α-fetoprotein) both preorchiectomy and postorchiectomy. We then compared these values with the actual staging and tumor markers determined by patient medical record review by a single urologist.

Results: A high proportion of registry records were found to have inaccurate values of category: 71% of S category entries and 34% of N category entries, leading to an overall group stage inaccuracy of 77% in SEER data. Accuracy of overall combined stage group was significantly different between hospitals, with a higher percentage of errors at Hospital A ($P < 0.05$).

Conclusion: Despite improvements made to the SEER criteria for extracting data used to code testicular germ cell tumor TNM stage, considerable errors were identified, most notably in tumor marker and nodal status, resulting in an overwhelming number of errors in overall stage. Our findings suggest caution when utilizing SEER data for review of patients with testicular cancer and their staging. Published by Elsevier Inc.

Keywords: Testis cancer; Germ cell tumor staging; SEER

1. Introduction

Testicular germ cell tumors (TGCTs) are the most common neoplasm of young men in the United States, with an estimated 8,590 new cases and 360 TGCT deaths in 2012 [1]. These cancers are highly curable, and from 2001 to 2007 the estimated 5-year survival rate for patients with TGCT was 97% [2]. Diagnostic and treatment decisions rely on accurate staging of tumors, which in turn depends in part on serum measurement of the tumor markers, beta-human chorionic gonadotropin (β-HCG), lactate dehydrogenase (LDH), and α-fetoprotein (AFP). Utilization of germ cell tumor markers for staging, prognostic, and treatment purposes has been extensively studied and reported [3]. Germ cell tumor markers play a vital role in not only staging but also assessing prognosis [4], and thereby making meaningful measures of trends in occurrence and survival.

The National Cancer Institute's Surveillance, Epidemiology, and End Results (SEER) program collects data from population-based cancer registries covering approximately 28% of the population of the United States, providing incidence and survival data used to measure cancer burdens, recognize important trends, formulate new hypotheses, establish research and clinical priorities, and evaluate consequences of preventive and therapeutic interventions. The value of registry data depends critically upon accuracy,

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which is generally considered very high. However, determination of clinical stage of TGCTs has unique challenges owing to reliance of clinical stage on tumor markers assessed following orchiectomy. In 2004, the SEER Collaborative Stage (CS) version 1 began to include tumor markers into the staging for testicular cancer patients, in accordance with the American Joint Committee of Cancer (AJCC) TNM staging [5]. However, these guidelines did not specify whether preorchiectomy or postorchiectomy tumor markers were to be extracted. In 2010, an effort was made to correct this ambiguity by implementation of the CS version 2 guidelines, which instruct registrars to extract both preorchiectomy and postorchiectomy tumor markers, the latter to be incorporated into the S category, corresponding to the 7th edition of the AJCC TNM staging [6]. As each marker has a separate half-life, extracting tumor markers too early may lead to erroneously high estimates of tumor category. We, therefore, hypothesized that SEER registry data may contain some degree of systematic error in the staging of TGCTs even after introduction of CS version 2 guidelines in 2010. To assess this possibility we conducted a validation study comparing category registered with SEER to that determined by a urologist based on review of original medical record data for patients with TGCT treated at University of Southern California (USC)–associated hospitals.

2. Materials and methods

We identified within SEER records incident TGCT diagnosed at USC-associated hospitals from January 2010 to July 2011. A single urologist then reviewed all available medical records for patients meeting these criteria and recorded TGCT clinical stage for each patient at presentation according to the AJCC 7th edition TNM staging criteria. T category was determined from the orchiectomy pathology report as available. If chemotherapy was instituted before orchiectomy or no path report available, category Tx was recorded. N and M categories were determined by review of imaging at presentation, as long as the imaging procedure preceded initiation of systemic treatment, such as chemotherapy, radiation, or retroperitoneal lymph node dissection. S category was determined by evaluation of postorchiectomy tumor markers, after allowing appropriate time for the markers to normalize based on their preorchiectomy value and individual half-lives. The normal values for the tests are LDH < 220, AFP < 8.3, and β-HCG < 5. If markers were persistently elevated and not declining appropriately based on half-lives, the lowest value measured before initiation of further therapy was used to score stage. In 2 cases, no tumor markers were drawn after orchiectomy owing to loss of follow-up; however both patients had normal tumor markers before surgery, hence a stage of S0 was scored. In the setting of advanced disease where no tumor markers were drawn between orchiectomy and initiation of chemotherapy, preorchiectomy tumor markers were used to determine S category. If chemotherapy was instituted before orchiectomy, the tumor markers before chemotherapy were utilized for the S category. Similarly, if retroperitoneal lymph node dissection was performed at the time of orchiectomy, S category was determined by tumor marker values before surgery. If tumor markers were declining appropriately after orchiectomy, but the patient was lost to follow-up before further markers could be drawn, SX was scored. Finally, T, N, M, and S categories were combined to score overall stage for each patient. All available preorchiectomy and postorchiectomy tumor markers were also recorded.

This study was conducted in collaboration with the USC-affiliated Los Angeles County Cancer Surveillance Program (CSP) at USC. The authors were provided with detailed SEER registry data for the patients treated at both contributing to the study. In this way, the authors were able to review individual patient data as recorded by the registrar when necessary. Values of T, N, M, S, and overall stage scored by the urologist for each patient were compared with values registered in SEER data for the same individual, the latter was provided by the CSP. These SEER data included an S category for each individual tumor marker corresponding to both preorchiectomy and postorchiectomy periods and a value range for AFP and β-HCG (i.e., preorchiectomy β-HCG might be specified by the range 50–59, with S category scored as 1). Range of LDH values was not provided, presumably because S category is based on a multiple of normal, as opposed to an actual value range (i.e., S2 is scored for LDH values between 1.5 and 10 times normal). The staging by both SEER personnel and the urologist was based on the guidelines provided by AJCC 7th edition TNM staging criteria.

Statistical analysis estimating agreement between SEER and clinically determined values of each stage component was performed using a weighted kappa coefficient implemented by the statistical software package SAS, version 9.2 (Cary, NC). Continuous variables were described in terms of median and range, and categorical variables with proportions. All P values were double-sided, with $P < 0.05$ being deemed significant.

3. Results

Among patients with TGCT treated at USC-affiliated hospitals, 76 were identified as having data abstracted into the SEER registry following adoption of CS version 2 in January 2010. Characteristics of these patients are summarized in Table 1. Instances of disagreement between tumor stage as coded by the SEER registry and tumor stage as determined by an urologist are summarized in Table 2. We interpreted disagreement as representing error in SEER data. The N, M, and S categories were scored both by urologist review and SEER registry personnel for all 76