Nomograms to Estimate Long-term Overall Survival and Breast Cancer-Specific Survival of Patients with Luminal Breast Cancer

Wei sun, PhD

Department of Breast Surgery, Fudan University Shanghai Cancer Center, ShangHai, China, 200032.

BACKGROUND: Luminal breast cancer (estrogen receptor [ER] and/or progesterone receptor [PR] positive) represents approximately two-thirds of all breast cancer. This type of cancer constitutes a group of highly heterogeneous diseases with a sustained high risk of late recurrence.

HYPOTHESIS: In the current study, we aimed to develop comprehensive and practical nomograms for the first time to better estimate the long-term survival of luminal breast cancer. Thus, those patients with high risk of late recurrence and poor prognosis could be screened out, and more aggressive treatments can be applied on them.

METHODS: Patients with luminal breast cancer diagnosed between 1990 and 2006 were retrieved from the Surveillance, Epidemiology, and End Results (SEER) database, and randomly divided into the training (n=87,867) and validation (n=88,215) cohorts. The inclusion criteria we used to identify eligible patients were as follows: female, age from 18 to 79 years old at diagnosis, known time of diagnosis from January 1, 1990, to December 31, 2006, unilateral breast cancer, breast cancer as the first and only cancer diagnosis, diagnosis not obtained from a death certificate or autopsy, surgical treatment with either mastectomy or breast-conserving surgery, pathologic confirmation of invasive carcinoma, AJCC stages I-III, histological grade I-III, and known estrogen receptor (ER) and progesterone receptor (PR) statuses. Patients with inflammatory breast cancer or Paget's disease and any missing value of above variables were also excluded. Univariate and multivariate survival analyses were applied to identify prognostic factors for overall survival (OS). The cumulative incidence function (CIF) and a competing-risks model were used to estimate the probability of breast cancer-specific survival (BCSS) and death from other causes. We integrated significant prognostic factors to build nomograms, and subjected the nomograms to bootstrap internal validation and external validation.

RESULTS: We screened 176,082 luminal breast cancer cases. The mean age at diagnosis was 57.5 years, and mean survival time was 107.4 months. By the end of the last follow-up, 36,911 (21.0%) patients had died, including 17,855 (10.1%) died from breast cancer and 19,056 (10.8%) from other causes. The 5- and 10-year probabilities of overall death were 0.089 and 0.202, respectively. The 5- and 10-year probabilities of breast cancer specific-mortality (BCSM) were 0.053 and 0.112, respectively. Nine independent prognostic factors for both OS and BCSS were integrated to construct the nomograms, including age at diagnosis, race, tumor size, histology, grade, positive lymph nodes, ER/PR status and radiation. The calibration curves for the probabilities of 5- and 10-year OS and BCSS showed excellent agreement between the nomogram prediction and actual observation. The C-indexes of the nomograms were high in both internal validation (0.732 for OS and 0.800 for BCSS) and external validation (0.731 for OS and 0.794 for BCSS). In conclusion, this nomogram can identify patients with higher risk of late overall mortality and BCSM, helping physicians in facilitating individualized treatment.