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Prognostic determinants and treatment outcomes analysis of osteosarcoma and Ewing sarcoma of the spine

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Abstract

Background context: Osteosarcoma (OGS) and Ewing sarcoma (EWS) are the two classic primary malignant bone tumors. Due to the rarity of these tumors, evidence on demographics, survival determinants, and treatment outcomes for primary disease of the spine are limited and derived from small case series.

Purpose: To use population-level data to determine the epidemiology and prognostic indicators in patients with OGS and EWS of the osseous spine.

Study design/setting: Large-scale retrospective study.

Patient sample: Patients diagnosed with OGS and EWS of the spine in the Surveillance, Epidemiology, and End Results (SEER) registry from 1973 to 2012.

Outcome measures: Overall survival (OS) and disease-specific survival (DSS).

Methods: Two separate queries of the SEER registry were performed to identify patients with OGS and EWS of the osseous spine from 1973-2012. Study variables included age, sex, race, year of diagnosis, tumor size, extent of disease (EOD), and treatment with surgery and/or radiation therapy. Primary outcome was defined as OS and DSS in months. Univariate survival analysis was performed using the Kaplan-Meier method and the log-rank test. Multivariate analysis was performed using Cox proportional hazards regression models.

Results: The search identified 648 patients with primary OGS and 736 patients with primary EWS of the spine from 1973 to 2012. Mean age at diagnosis was 48.1 and 19.9 years for OGS and EWS, respectively, with OGS showing a bimodal distribution. The median OS and DSS were 1.3 and 1.7 years, respectively, for OGS, with OGS in Paget's disease having worse OS (0.7 years) relative to the mean (log-rank $p=.006$). The median OS and DSS for EWS were 3.9 and 4.3 years, respectively. Multivariate cox regression analysis showed that age (OS $p<.001$, DSS $p<.001$), decade of diagnosis (OS $p=.049$), surgical resection (OS $p<.001$, DSS $p<.001$), and EOD (OS $p<.001$, DSS $p<.001$) were independent positive prognostic indicators for spinal OGS; radiation therapy predicted worse OS (hazard ratio [HR] 1.48, confidence interval [CI] 1.05-2.10, $p=.027$) and DSS (HR 1.74, CI 1.13-2.66, $p=.012$) for OGS. For EWS, age (OS $p<.001$, DSS $p<.001$), surgical resection (OS $p=.030$, DSS $p=.046$), tumor size (OS $p<.001$, DSS $p<.001$), and EOD (OS $p<.001$, DSS $p<.001$) were independent determinants of improved survival; radiation therapy trended toward improved survival but did not achieve statistical significance for both OS (HR 0.76, CI 0.54-1.07, $p=.113$) and DSS (0.76, CI 0.54, 1.08, $p=.126$).

Conclusions: Age, surgical resection, and EOD are key survival determinants for both OGS and EWS of the spine. Radiation therapy may be associated with worse outcomes in patients with OGS, and is of potential benefit in EWS. Overall prognosis has improved in patients with OGS of the spine over the last four decades.

Keywords: Ewing sarcoma; Osteosarcoma; Radiation therapy; Spine; Surgical resection; Survival.

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Figures

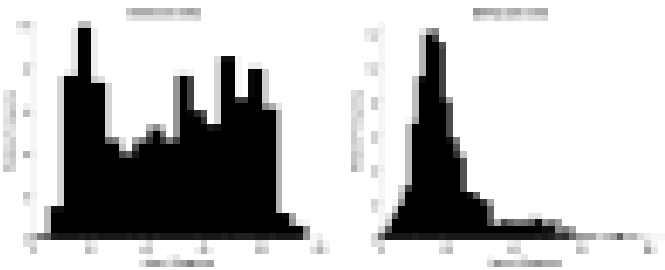


Fig. 1

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Age distribution histograms for cohorts...

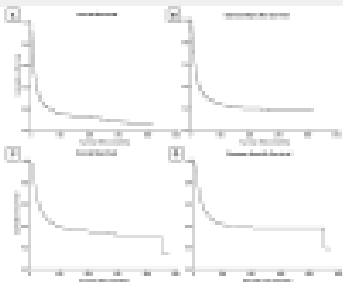


Fig. 2

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Kaplan-Meier analysis of overall survival...

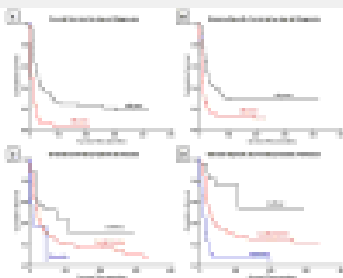


Fig. 3

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Kaplan-Meier analysis demonstrating overall survival...

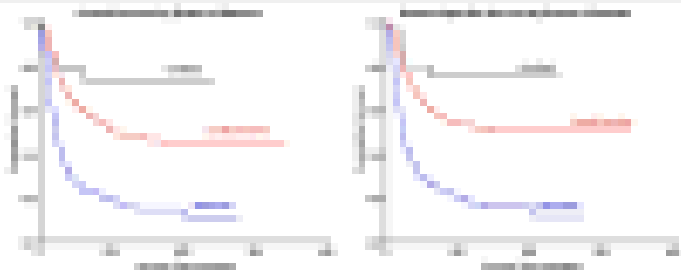


Fig. 4

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Kaplan-Meier analysis demonstrating (left) overall...

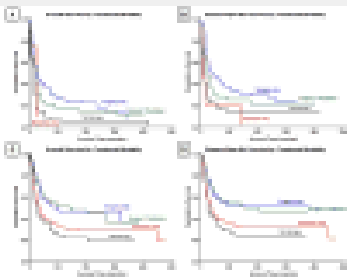


Fig. 5

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Kaplan-Meier analysis demonstrating overall survival...