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Clinical Study

Epidemiologic, functional, and oncologic outcome analysis of spinal sarcomas treated surgically at a single institution over 10 years

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Abstract

BACKGROUND CONTEXT: Spinal sarcomas are aggressive tumors that originate from the cells of mesechymal origin, specifically fat, cartilage, bone, and muscle. They are high-grade lesions, and treatment of spinal sarcomas can involve chemotherapy, radiation therapy, and surgery. In the appendicular skeleton, sarcomas are often treated with amputation, however, in the spinal column, surgical resection poses a unique set of challenges.

PURPOSE: To better understand the optimal treatment regimens and the impact of en bloc or intralesional resection on patient outcome.

STUDY DESIGN: A cohort of 25 sarcoma patients treated at a single medical institution between 2002 and 2012 was reviewed.

PATIENT SAMPLE AND OUTCOME MEASURES: Patients were classified by tumor type for subgroup analysis, including chondrosarcoma, osteosarcoma, and other malignant spinal sarcomas. Demographic data for review included patient age, tumor type, tumor location, surgery type, exposure to chemotherapy, and radiation therapy.

METHODS: Survival statistics and Kaplan-Meier curves were calculated using GraphPad Prism 5.0. The threshold for statistical significance was set at $p<.05$. Unpaired, two-tailed, equal variance *t* tests were performed for statistical analyses in Microsoft Excel 2010.

RESULTS: Twenty-five patients with spinal sarcomas were treated over the 10-year period. Diagnosis included chondrosarcoma (n=9), osteosarcoma (n=4), and other sarcomas (n=12). Mean age at the time of diagnosis was 42 years. Pain was present at the time of diagnosis in 92% patients. Median survival after surgery was 59.5 months for chondrosarcoma, undefined for other sarcomas, and 16.8 months for osteosarcoma. Median survival after en bloc resection was undefined. Median survival after intralesional resection was 17.8 months. The difference in median survival between en bloc and intralesional resection was statistically significant ($p=.049$).

CONCLUSIONS: The authors report the largest cohort of patients with spinal sarcoma. Median survival in this cohort was the longest for patients with sarcomas of varying pathologies. Median survival was longer for chondrosarcoma. En bloc resection demonstrated a survival advantage over

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intralesional resection. Long-term follow-up is needed for patients with spinal sarcoma to establish definitive survival data.

Keywords: Sarcoma; Osteosarcoma; Chondrosarcoma; Outcome; Spine; Tumor; Surgery; En bloc

Introduction

Spinal sarcomas are a rare group of spinal malignancies that are associated with high rates of morbidity and mortality. Epidemiologic studies of spinal sarcomas, such as from the Surveillance Epidemiology and End Results database cancer statistics review from 1975 to 2009, demonstrate that sarcomas represent less than 5% of all osseous neoplasms and less than 0.2% of all new cancers [1,2]. Sarcomas can occur in a variety of osseous regions throughout the body. However, sarcomas of the spine and surrounding structures often elicit debilitating consequences because of severe focal pain and neurologic morbidity.

Chondrosarcoma represents 25% of sarcomatous tumors and increases in likelihood in patients older than 50 years [3–6]. Chondrosarcomas are part of a family of malignant tumors, where the cells differentiate uncontrollably into cartilaginous tissue. It is further classified as central, peripheral, or periosteal, with mesenchymal and clear cell variants [7]. Osteosarcoma tends to be more common, representing 35% of all sarcomas and 3% to 15% of all primary spine tumors. There exist a variety of subtypes including conventional osteosarcomas, telangiectatic, small-cell and giant-cell, epithelioids, and osteoblastoma-like osteosarcomas [8,9].

While previous studies have been confined by the limited patient data or the size of their patient population, this database of spinal sarcomas comprises 25 spinal sarcoma patients who underwent surgical resection at a single institution from 2002 to 2012. We investigated the impact of en bloc resection on patient outcome through analyzing a single institution's surgical management of spinal sarcomas over the last decade. Although the Surveillance Epidemiology and End Results database provided invaluable epidemiologic data of 1,378 sarcoma patients, it did not stratify the outcomes based on surgical approach from each surgical institution separately. Thus, by looking only at the patients from a single institution during a single decade, this study allows for a controlled standard of care that we hope may then be used by neurosurgical and orthopedic spinal surgeons to determine functional and oncologic survival data for a variety of surgical techniques and treatments.

Methods

Study population

Demographic, treatment, and outcome data were collected retrospectively from the electronic medical record following protocols dictated by the institutional review board (IRB application NA_00066200). Twenty-five consecutive patients with histology-confirmed spinal sarcomas treated at a single institution from 2002 to 2012 were reviewed. Patient medical records including clinic notes, primary radiographs, computed tomography (CT) scans, and magnetic resonance imaging (MRI) were reviewed. Pathology reports were also reviewed.

Study criteria

All patients included in this study presented with histologically confirmed sarcoma of the spine. Covariates identified were epidemiologic data such as age, gender, length of hospitalization, location of sarcoma, number of spinal levels involved, surgical approach, tumor volume, pathology of sarcoma, extent of resection, pain at diagnosis, Frankel score, presence of myelopathy and cauda equina, adjunctive treatment, local recurrence, and overall survival. The diagnosis of other sarcomas included epithelioid sarcoma (n=3), pleomorphic undifferentiated sarcoma (n=2), spindle cell sarcoma (n=2), alveolar soft part sarcoma (n=1), unusual low grade sarcoma (n=1), postradiation sarcoma (n=1), fibromyxoid sarcoma (n=1), and Ewing sarcoma (n=1).

Surgical approach was recorded from operative notes. Pain at diagnosis was self-reported by patients at any preoperative clinic visit within 3 months of surgery. The number of spinal levels involved and the presence or absence of a pathologic fracture were determined from the radiology reports of preoperative CT and MRI scans.

Vital statistics were recorded from the Social Security Death Master File accessed online. All vital statistics reflect the status of patients as of July 31, 2012. Survival data for non-US citizens were recorded as unknown. Recurrence data are recorded for all patients at the last clinical follow-up. Recurrence was determined from the postoperative neurosurgery clinic notes, reporting the neurosurgeon's interpretation of radiographic recurrence at the time of last follow-up.

Tumor size and volume were recorded from the primary review of preoperative MRI or CT scans. Volume was calculated via the formula for the volume of an ellipsoid ($[4\pi/3]r^1r^2r^3$). Radii were taken as one-half the cranial-caudal, anteroposterior, and lateral measurements of the tumor. Measured values were corroborated with radiology reports.

After surgery, patients were seen at 1 month, then at 3, 6, 9, and 12 months. Patients were followed every 6 months in the second year, then yearly, or as clinical progression dictated their plan of care. Magnetic resonance imaging with and without contrast was used to evaluate tumor recurrence at the time of clinical follow-up. Early, defined as occurring within 30 days postoperatively, and late complications,