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A Review on Primary Bone Tumor: Considerations for Treatment-Induced Complications

Marya Branco*

Department of Radiology, State University of Campina, Brazil

Abstract

It is critical to identify a benign primary osseous tumor because adult and pediatric patients present with distinct symptoms. A neoplasm that is curable may progress into a lethal one with the wrong treatment, resulting in patient morbidity and mortality. Understanding the subtype of tumor and whether it is a malignant or benign neoplasm is essential once the diagnosis of a primary bone tumor has been made. While only 40% of PBTSs in children are malignant, approximately 80% of PBTSs in adults are. This study aims to examine the special considerations for benign tumors in adults and children.

Keywords: Bone Tumor; Neoplasm; Scoliosis; Kyphosis

Introduction

Primary bone tumors are the third most common tumor in adolescents and young adults and the sixth most common neoplasm in pediatric patients, with a peak incidence occurring between the ages of 15 and 19 [1]. The location of these tumors, which influences a patient's symptoms and outcomes, allows for classification. 95% of patients experience unspecified back pain as a result of these neoplasms, which affect the spine in about 4–13% of cases. According to studies, in addition to experiencing back pain, 25% of children who have primary bone tumors of the spine (PBTS) also have structural abnormalities like scoliosis, kyphosis, and lordosis; 22 percent exhibit symptoms of cord compression [2]; Moreover, 52 percent of people with malignant PBTS have neurological problems. Hyperreflexia, hypotonia, weakness, and sensory deficits are symptoms of cervical or thoracic spine tumors. On the other hand, tumors in the lumbar and sacral spine present with hypotonia, hyporeflexia, and bowel/bladder dysfunction in the lower motor neurons.

Because the treatment of these tumors differs greatly, it is critical to distinguish between a primary osseous tumor and a metastatic spinal lesion. A neoplasm that is curable may progress into a lethal one with the wrong treatment, resulting in patient morbidity and mortality. Follow-up testing for a single spinal lesion may include positron emission tomography (PET) scans [3], computed tomography (CT) scans, magnetic resonance imaging (MRI), and biopsy to confirm the diagnosis. Understanding the subtype of tumor and whether it is a malignant or benign neoplasm is essential once the diagnosis of a primary bone tumor has been made. While only 40% of PBTSs in children are malignant, about 80% of PBTSs in adults are malignant. However, aggressive behavior, such as aggressive local growth patterns, destruction of adjacent structures, neurologic impairment, and a high risk of recurrence, can also occur in benign tumors.

These tumors can cause significant long-term morbidity and mortality in young adults and children. The histologic subtype determines the treatment for PBTS. Eosinophilic granuloma, osteoid osteoma, osteoblastoma, osteochondroma, aneurysmal bone cyst, and giant cell tumor are the six main types of benign PBTS. Active lesions typically necessitate aggressive treatment [4], whereas latent lesions can typically be observed. Curette, embolization, bone grafting, marginal resection, or decompression was previously used to treat the more aggressive neoplasms. With recurrence rates ranging from 40% to 60%, outcomes remained poor. With recurrence rates reduced to 4–7%, radical resection with total en bloc spondylectomy (TES) has become the gold standard for aggressive tumor treatment over the past decade.

According to a number of studies, intralesional surgery was successful in achieving local control in 72.2 percent of cases of giant cell tumor, 22% of cases of chordoma, and 0% of cases of chondrosarcoma; Local control was achieved with total en bloc resection with free margins in 92.3% of giant cell tumors, 78% of chordomas, and 82% of chondrosarcomas. Adult outcomes are primarily represented by these data. Sadly, the improved rates of long-term survival achieved by radical resection are offset by an increase in morbidity. One study found that 34.3 percent of TES patients experience complications [5]. While patients undergoing TES had a 100% one-year survival rate, a smaller study found that the rate of morbidity for such a complex surgery was a significant 67%.

Because their spine is still developing, pediatric PBST patients present and have a different complication profile than adults. Scoliosis can be diagnosed at the time of a tumor's presentation or it can progress after surgery. Although scoliosis can occur earlier or later in life, it is typically diagnosed during adolescence and thought over 80% of the time to be idiopathic. Scoliosis with red flag symptoms like pain that lasts longer than four weeks, point tenderness, and pain that gets worse at night may be caused by something more serious like a spine tumor. In patients moderately overseen for PBTS, movement of their previous scoliosis can cause a huge number of issues, one of the most extreme being restricted cardiopulmonary capability from thoracic deficiency condition. In one study, significant adult-onset scoliosis progression was found in 68% of patients with a scoliosis curvature greater than 30 degrees. Bony instability is brought on by the asymmetric load that this persistently abnormal spinal curvature places on the spinal column [6]. As a result, facet joint and vertebral endplate osteophyte formation occurs over time, resulting in spinal stenosis that frequently

***Corresponding author:** Marya Branco, Department of Radiology, State University of Campina, Brazil, E-mail: marya45@gmail.com

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necessitates decompression surgery. Consequently, Wolff et al. X-rays should be taken every five years to monitor scoliosis over 20 degrees for progression and prognosis.

Spinal deformity is a frequent complication in PBTS patients who require treatment. Through adverse effects on structural integrity or bone density, surgery, chemotherapy, and radiotherapy are all known to cause spinal instability. The resulting disability necessitates close follow-up care into adulthood as children are surviving longer with improved tumor treatments. Post-laminectomy spinal deformity in children is reported to occur between 25% and 46% of the time when primary bone tumors are treated. Younger children are more likely to experience this condition. To avoid long-term structural deficits in children who need tumor resection, some recommend performing osteoplastic laminectomy and reconstruction instead of laminectomies. Based on intraoperative stability, the researchers discovered that between 20% and 50% of patients who underwent surgical resection of osteoid osteomas and osteoblastoma required simultaneous fusion. Otherwise, after tumor treatment, the only definitive treatment for spinal deformity is adult reoperation with spinal fusion, which also comes with its own set of complications.

Discussion

In addition, radiation therapy poses a threat of secondary malignancy, difficulties with fertility, and delayed growth in children. If an adult patient with PBST has already reached puberty and is no longer concerned with fertility preservation, radiation therapy may be administered more liberally. In the pediatric populace, radiation may likewise harm endochondral development plates, which cutoff points bone recuperating and vertebral remaking. Radiation-related scoliosis, chronic back pain, avascular necrosis, slipped epiphyses, and other structural dysfunction can all result from this, which can cause growth arrest in the developing skeleton of children undergoing PBTS treatment. Additionally, children are particularly susceptible to post-radiation sarcoma and myelitis as secondary radiation-related complications. Other sources estimate an incidence of between 0.9% and 2%, whereas the rate of radiation-induced malignancy associated with osteoid osteomas treated with radiation therapy was previously reported to be less than 1%. Pediatric patients treated for PBTS should be monitored into adulthood for the development of secondary tumors due to the 10-year mean latency period for these tumors. These secondary neoplasms are aggressive and frequently more lethal than the primary tumor, despite their rarity. As a result, prompt diagnosis and treatment are essential.

Conclusion

As a result, the field of neurosurgery's long-term management of children with PBTS remains a complex and relatively unexplored area. Clinicians and researchers don't have a lot of experience treating these patients because of the low incidence of these tumors. As a result, there are different ways to diagnose and treat these patients. Patients also face an increase in rates of morbidity that needs to be taken into consideration as improved treatment standards raise survival rates. In general, the goal of this chapter is to identify management options for these pediatric patients as they grow up.

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