

# **Surgical Management of Spinal Tumors in Children and Adolescents**

*Thesis*

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**Orthopaedic Surgery**

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## **Abstract**

**Objective:** Vertebral tumors of the pediatric spine are rare, and most of the reported series have limited numbers of cases. Diagnosis of these tumors is difficult because of the patients' age and the rarity of the lesions. We aimed to report the clinical and radiological features of vertebral tumors in a small series of pediatric patients and to discuss diagnostic and treatment difficulties.

**Materials and Methods:** Medical charts and radiographic records of 10 pediatric patients with documented vertebral tumors treated between January 2011 and December 2014 in Kasr Al Ainy Teaching Hospital, Cairo University and Children Cancer Hospital, Egypt were reviewed retrospectively.

**Results:** The mean age was 12.9 years, and there were 8 male and 2 female patients. The most common symptom was pain. There were neurological or local findings in all patients and there were positive results on plain radiographs in all cases except one. There were histologically malignant lesions in 4 and benign lesions in 6 cases. En bloc tumor resection was performed in 3 cases. Three patients with malignant tumors were treated by chemotherapy post-operatively. Two patients, a 5 year-old girl with chordoma of C1 & C2 segments and base of skull and a 17 year-old boy with metastatic osteosarcoma to D8 died 7 and 18 months respectively, post palliative surgery due to tumor-associated deterioration in their medical condition. The average duration of follow-up of the patients was 8.5 months (range 6 to 18 months). The preoperative neurological deficits were resolved completely at the last follow-up in two patients while the remaining showed varied extent of neurological recovery except for a 20 year-old girl with metastatic osteosarcoma to L3, ribs and lungs. She became paraplegic and developed urinary and stool incontinence along with distal right-sided lower limb DVT 3 months post-operatively. No neurological improvement was noted during her last follow-up. With the exception of a 12 year-old boy with Langerhaans Cell Histiocytosis who despite surgery continued to suffer from pre-operative cervico-dorsal kyphosis, there were no new spinal deformities on the last follow-up of the remaining 9 patients.

**Conclusion:** Children with spinal tumors usually present with pain and neurological deficits or local findings, and there are usually indications on plain radiographs. Therefore, a careful physical examination and detailed evaluation of radiographs may minimize the rate of misdiagnosis and underestimation. Most of these tumors are benign, therefore, their outcome is good, and cure may be possible for many of the cases.

**Key Words:** Pediatric spine , Spinal tumors , Vertebral tumors

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

"قَالُوا سُبْحَانَكَ لَا عِلْمَ لَنَا إِلَّا مَا

عَلَّمْتَنَا إِنَّكَ أَنْتَ الْعَلِيمُ الْحَكِيمُ"

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## *List of Abbreviations*

ABC	Aneurysmal Bone Cyst
AP	Anterior-Posterior
CCS	Conventional Chondrosarcoma
CRP	C reactive protein
CT	Computed Tomography
DVT	Deep Vein Thrombosis
EG	Eosinophilic Granuloma
ES	Ewing's Sarcoma
ESR	Erythrocyte Sedimentation Rate
GCT	Giant Cell Tumor
HME	Hereditary Multiple Exostoses
LCH	Langerhans Cell Histiocytosis
MCS	Mesenchymal Chondrosarcoma
MRI	Magnetic Resonance Imaging
NSAID	NonSteroidal Anti-Inflammtory Drugs
OS	Osteosarcoma
PET	Positron Emission Tomography
RT	Radiotherapy
SCC	Spinal Cord Compression
SEER	Surveillance, Epidemiology and End Results
SOSG	Spinal Oncolgy Study Group
SPECT	Single Photon Emission Computerized Tomography
SRS	Stereotactic Radio-Surgery
WBB	Weinstein- Boriani- Biagini
WHO	World Health Organization

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# *INTRODUCTION*

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## **Introduction**

Spinal tumors in the pediatric population are a relatively rare occurrence and constitute a heterogeneous group of pathologies that present a significant clinical challenge to the orthopedic surgeon involved in their diagnosis and management. They should be always considered in the differential diagnosis of back pain in the pediatric and adolescent population. They can be primary i.e. originate from the neural elements of the spine or metastatic i.e. source from other parts of the body and manifest in the vertebral column. Spinal neoplasms can also be benign or malignant. In children and adolescents, primary benign tumors of the spine are much more common than malignant variants. Overall, less than 30% of all primary bony tumors in children are malignant, with only a small proportion affecting the spine [1].

Pain is the most common presenting symptom of children with bone tumors of the spine in approximately 90% [2]. Compared to the usual evaluation and treatment for back pain in adults, children with significant back pain deserve earlier and more extensive work-up, since far less is known about the true incidence and causes of back pain in this age group. Some estimate the prevalence of back pain in the 2nd decade as high as 36%, with only 10% or less of these children requiring or seeking medical assistance [3]. The most frequent causes of back pain in children are trauma, infection, spondylolysis and spondylolisthesis.

When a child presents for evaluation of back pain and a bone lesion is identified, there is often anxiety on the part of the family and evaluating physician. Nonetheless, bone tumors are far less common than fractures, normal developmental variations, congenital malformations, infection, metabolic disorders, and tumor-like lesions. The clinical and radiographic features of these groups however may overlap [8].

During the evaluation and management of bone tumors of the pediatric spine, several steps and principles should be followed:

- Complete clinical work-up with high-quality and appropriate imaging, for adequate tumor staging.
- When a biopsy is performed, the technique used should be simple and safe, allowing for the best diagnostic yield without interfering with the definitive surgical plan.
- When indicated, adjuvant treatments or modalities should be used based on tumor natural history, stage, and the child's overall condition.
- If surgery is indicated, it should be performed based on a standardized spinal surgical staging system and the goals should be set and delineated in regards to margins and outcome.
- Whenever possible, efforts should be made to preserve neurological function, spine alignment and stability [8].

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The management of spinal tumors in children can be significantly different from that of adults and care must be taken to avoid generalizations regarding prognosis for neurologic recovery based on adult data. Management is dictated by both specific tumor pathology, as well as the severity of neurologic symptoms at presentation. Because of their rarity, management of spinal cord compression (SCC) secondary to spinal tumors in children remains controversial and includes decompressive and resective surgery, radiotherapy, chemotherapy, or a combination of the three [10].

Bone tumors involving the pediatric spine are usually primary and benign, with a favourable outcome if appropriate treatment is applied at an early stage. Any delay in diagnosis can lead to prolonged morbidity, as well as the development of spinal deformity. This can be either a painful scoliosis, which starts as an antalgic deformity but gradually becomes structural, or a deformity affecting the coronal and sagittal planes due to extensive osteolysis as the result of the destructive course of a neoplasm. Primary malignant bony tumors are less common, but are associated with more severe morbidity and often respond poorly to treatment, despite recent advances in surgical techniques, chemo- and radiotherapy [11].

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# *AIM OF THE WORK*

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