

# Osteochondroma of the Thoracic Spine and Scoliosis

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**Study Design.** The case of a 16-year-old patient with an osteochondroma in T11 and scoliosis is reported.

**Objective.** To describe the treatment of an osteochondroma with scoliotic deformity and the imaging methods used for the diagnosis.

**Summary of Background Data.** Osteochondromas arising in the vertebral column are rare. However, spinal involvement is found with some regularity because osteochondromas are among the most common benign tumors of bone.

**Methods.** The clinical history, plain radiographs, computed tomography, and magnetic resonance imaging, and pathologic findings of the reported patient were reviewed. The medical literature also was reviewed.

**Results.** The patient was treated with surgery in an attempt to remove the tumor and correct the aesthetic deformity. The results were satisfactory, with an improvement of the thoracolumbar scoliosis from 45° to 18°.

**Conclusions.** Osteochondromas of the vertebral column may cause scoliosis. Computed tomography and magnetic resonance imaging are necessary for evaluating the origin, size, and characteristics of the tumor. In this case, surgical management involved resection of the tumor and correction of the scoliotic deformity. [Key words: computed tomography, magnetic resonance imaging, osteochondroma, scoliosis] **Spine 2001;26:1082–1085**

Osteochondromas, also known as osteocartilaginous exostoses, are common tumors of bone that arise from any zone of endochondral bone formation in the context of a dysplastic disorder. They represent 9.3% of all bone tumors and 40% of all benign tumors. They may be solitary or multiple. Multiple osteochondromas can appear sporadically, but they usually occur as part of the genetic disorder known as hereditary multiple exostoses. This article describes a case of osteochondroma arising in T11 that caused rigid thoracolumbar scoliosis of 45° and presents a review of the literature.

## Case Report

A 16-year-old girl presented with a bone tumor in T11 and a rigid, progressive idiopathic scoliosis that was not painful but produced an aesthetic deformity (*i.e.*, left thoracolumbar rotation and asymmetry of the waist). The patient had been treated previously for 2 years at an outside hospital with a Boston brace, but without radiologic improvement. The neurologic examination was normal. No clinical signs of hereditary multiple exostoses were detected.

A plain radiograph showed a rigid thoracolumbar scoliosis spanning from T7 to L3. The curve had progressed over the 2 years since the previous treatment from 18° to 45°, with a Risser 4 (Figure 1a–1d). Lateral flexion showed a partial improvement of less than 50°.

The following findings were observed on computed tomography (CT) scan: a sclerotic osseous mass with multiple innering calcifications arising from the right pedicle and posterior arch of T11 (Figure 2), dysplastic changes in the vertebral bodies and pedicles of T11–T12 and L1, and degenerative facet changes in these locations. There was no osseous fusion between T11 and T12, which could account for the patient's deformity.

Magnetic resonance imaging (MRI) with T1- and T2-weighted coronal and transverse sections showed an osseous mass in the right posterior arch of T11 (hypointense with respect to the muscle in all the sequences), fat infiltration of the right vertebral body of T11 and T12, and marked atrophy with fat replacing the right paravertebral musculature. Neither intra- nor extradural involvement were detected (Figure 3a and 3b).

The method of correction was similar to that used in King 4 idiopathic scoliosis. The surgical procedure involved resection of the pedicles and lamina of T11 and T12 as well as posterior arthrodesis instrumented with C-D Horizon, which obtained a correction of the scoliosis from 45° to 18° (Figure 4). Fusión involved T6 to L3, with L3 included because L2 was outside the stable area of Harrington and appeared very rotated on the left bending test. Moreover, it was the L3–L4 disc that opened and closed during lateral flexions.

In the authors' opinion, excluding L3 supposedly would have fixed the instrumentation on rotated vertebrae (L1 and L2), with a consequent instability in the anteroposterior plane. By choosing T6 instead of T8, a setting in the apex of the thoracic spine on the sagittal plane was avoided, which would have produced a hyperkyphosis above the instrumentation. There were no intra- or postsurgical complications. The patient remained asymptomatic after a 2-year-follow-up period, with improvement of her aesthetic deformity and without abatement of the correction obtained immediately after surgery (Figure 5). Histologic examination of the submitted fragments showed cancellous bone with a cartilaginous cap consistent with osteochondroma (Figure 6).

## Discussion

In the vast majority of cases, osteochondromas involve the long bones. Their origin in the vertebral column is unusual, with an incidence of 1.3% to 4.1%,<sup>15</sup> and at this site they represent only 3.9% of the solitary tumors of the spine. Their incidence is slightly higher in patients with hereditary multiple exostoses (9%).<sup>15</sup> Osteochondromas occur with a higher incidence in men than women by a ratio of 1.5:1.<sup>9</sup> They usually give rise to clinical symptoms during growth in the second or third decade of life.

It is thought that osteochondromas originate in a laterally displaced part of the epiphyseal cartilage, resulting in a dysplastic osseous growth at the expense of a pro-

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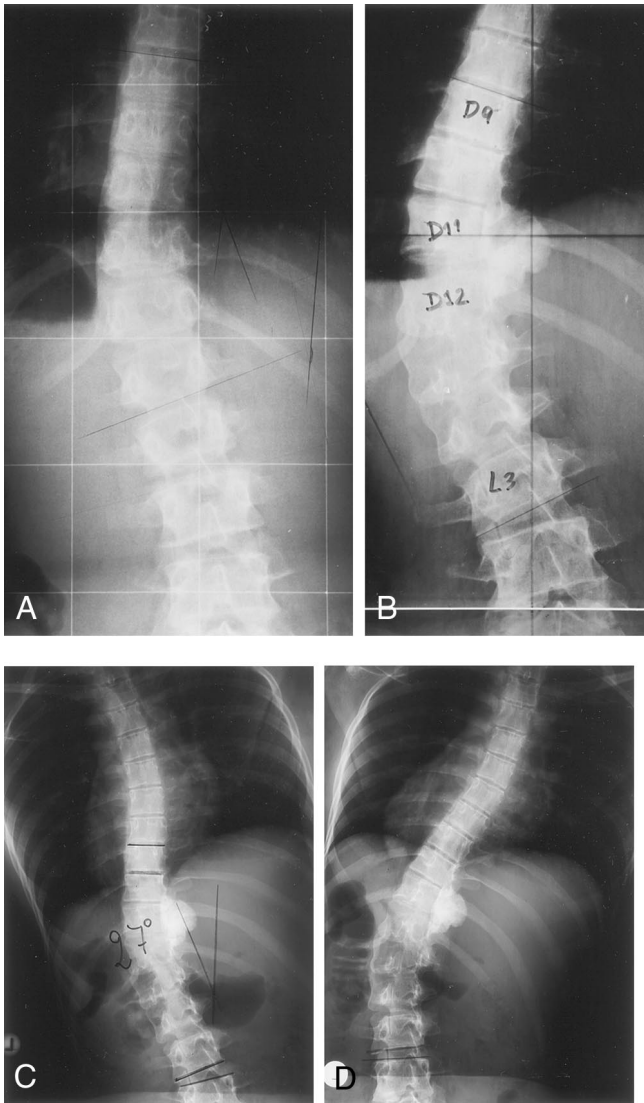


Figure 1. **a**, A 14-year-old girl who presented with a left thoracolumbar scoliosis measuring 18°. **b**, Anteroposterior teleradiograph after 2 years demonstrating a curved T7–L3 of 45° and an excrescent osseous tumor in T11–T12. **c,d**, Bending test showing partial improvement, from 45° to 27°. L2 remains highly rotated.

gressive endochondral ossification.<sup>3</sup> Solitary osteochondromas of the spine most frequently involve the cervical column, particularly the atlantoaxial region.<sup>4</sup>

Osteochondromas originate next most frequently in the thoracic and lumbar spine. In the case of multiple lesions, the incidence of osteochondromas originating in the thoracic column increases. The favorite location of the osteochondroma in the column is at an eccentric position in the neural arch, with or without protrusion into the spinal foramen.<sup>10</sup> Adjacent osteosclerotic changes are seen frequently.

Osteochondromas of the column may have neurologic complications as a consequence of their expansive growth into the spinal foramen or the involvement of the paravertebral sympathetic centers.<sup>5–7</sup> A total of 41 cases have been reported. An osteochondroma in the anterior portion of the cervical column may cause of dysphagia or vascular compression.<sup>2</sup>

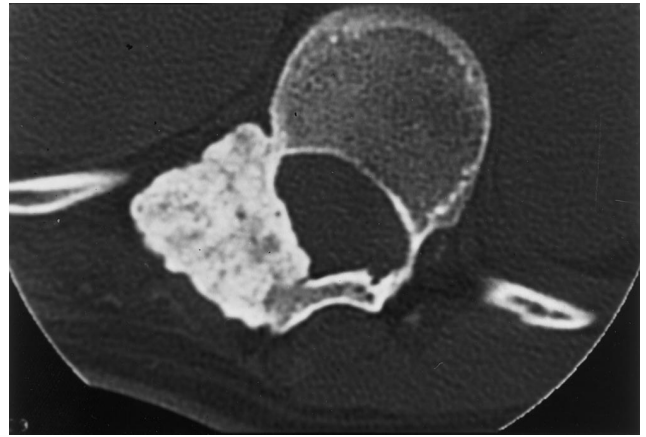


Figure 2. The computed tomography (CT) slices in T11 show an osseous mass arising from the right pedicle and neural arch with clot calcifications.

In a review of the literature, no solitary osteochondroma causing scoliotic deformity was found. The presence of unilateral dysplastic vertebral changes, degenerative processes, and fat infiltration of vertebral bodies suggests that the scoliosis results from alteration of the endochondral ossification in the epiphyseal vertebral plate of T11, T12, and L1, with a consequent delay in the longitudinal growth of the affected side and vertebral asymmetry. These alterations have been described in patients with multiple enchondromatosis.<sup>17</sup> In cases involving multiple osteochondromas of the spine, there may be osseous fusions, with restriction of movement.<sup>13,14</sup>

The tumors that cause a high frequency of scoliosis are the osteoid osteoma and the osteoblastoma.<sup>8</sup> The factors that determine its development are inflammatory alterations and unilateral spasm of the musculature secondary to pain.<sup>11</sup> The pathogenesis of these tumors differs from that in the current case.

The plain radiograph of the osteochondroma is characteristic: a sessile or pediculated mass adjacent to the marrow and the cortex of the bone from which it arises. Diagnosis and treatment frequently are delayed because of poor visibility for the tumor in the column. The combination of CT scan and MRI can establish the origin and size of the lesion more accurately.

A CT scan with thin sections and reconstructions demonstrates the typical findings of a benign osseous tumor with inner calcifications in continuity with the rest of the bone. Because an MRI better defines the involvement of soft tissues and the bone marrow, it is the gold standard for evaluation of intraspinal expansion and spinal cord compression.<sup>16</sup>

In the reported case, the aim of the treatment was complete resection of the tumor and correction of the aesthetic deformity. The surgical procedure was indicated to obtain correction of a scoliosis with a thoracolumbar curve similar to that in a King 4 idiopathic pattern.

The rate at which osteochondromas occur locally depends on how complete and adequate the surgical resec-

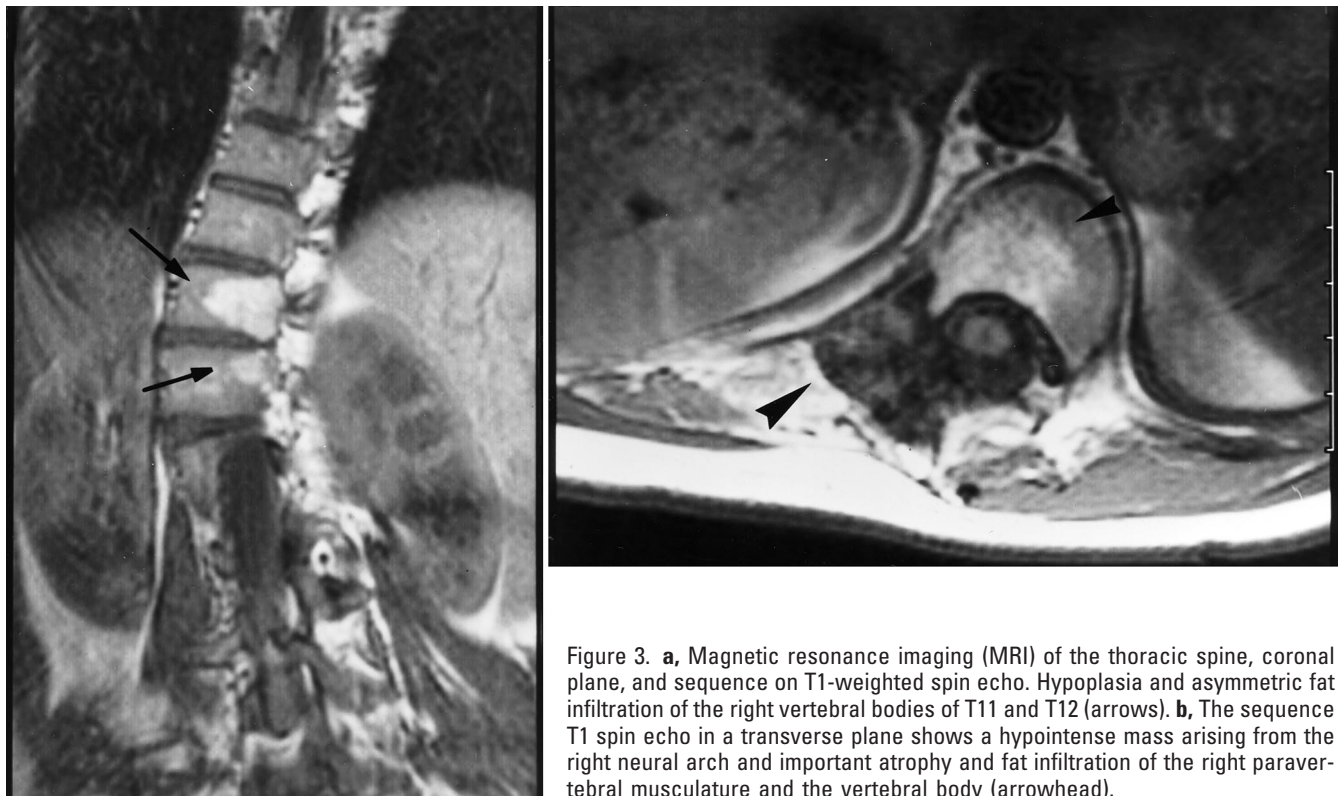


Figure 3. **a**, Magnetic resonance imaging (MRI) of the thoracic spine, coronal plane, and sequence on T1-weighted spin echo. Hypoplasia and asymmetric fat infiltration of the right vertebral bodies of T11 and T12 (arrows). **b**, The sequence T1 spin echo in a transverse plane shows a hypointense mass arising from the right neural arch and important atrophy and fat infiltration of the right paravertebral musculature and the vertebral body (arrowhead).

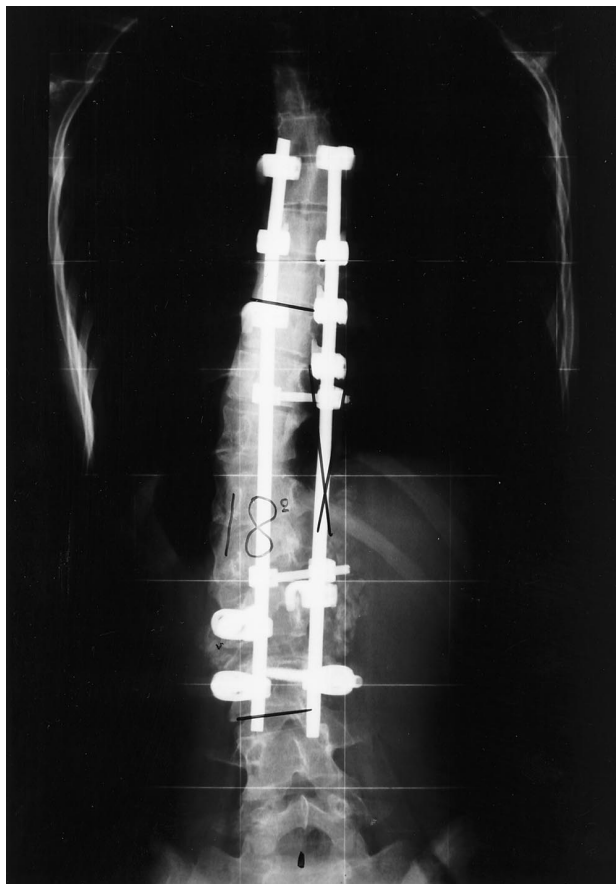


Figure 4. Spine after correction using tumor resection with arthrodesis and posterior instrumentation C-D Horizon. Physiologic sagittal plane curve at T7-L3 is 18°.

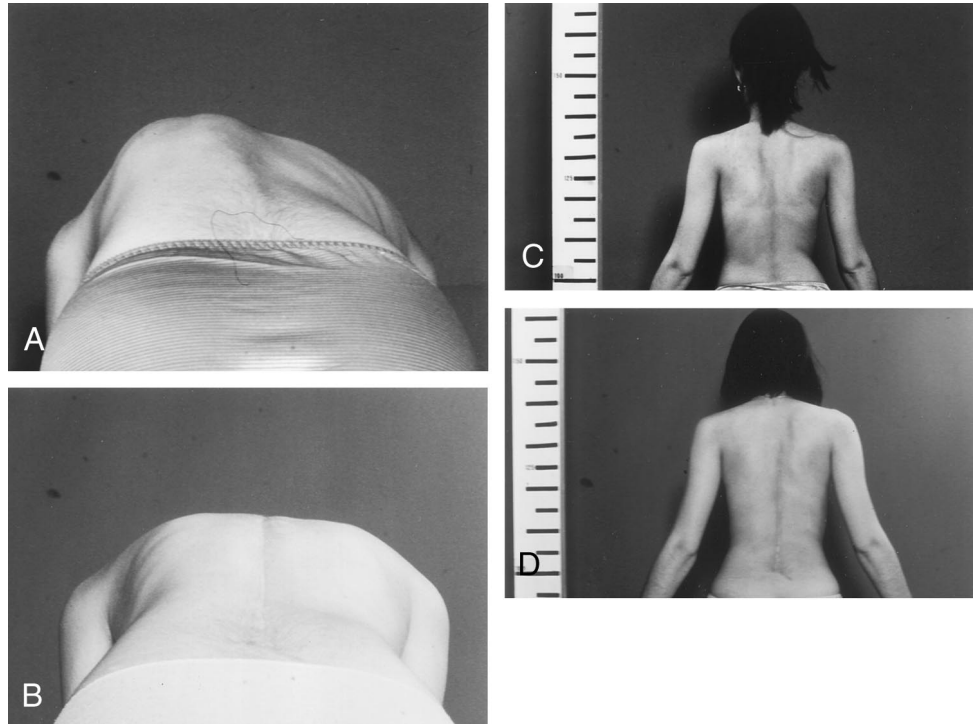


Figure 5. Correction of the aesthetic deformity involving asymmetry of the waist and thoracolumbar rotation. **a**, Before surgery. **b**, After surgery. **c**, Before surgery. **d**, After surgery.

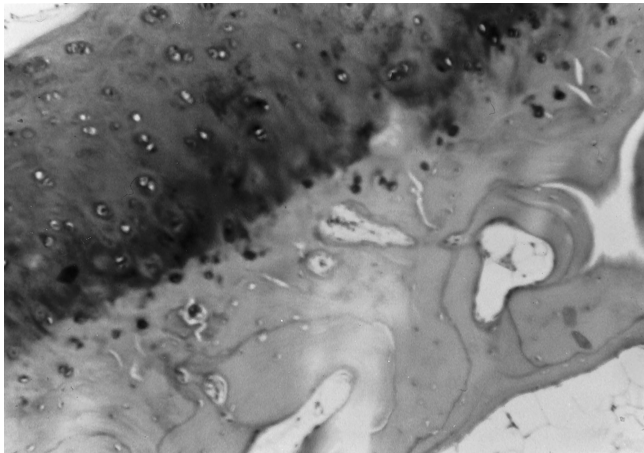


Figure 6. Histologic section of the lesion surface depicting a cartilaginous cap overlying somewhat sclerotic bone (hematoxylin and eosin stain; magnification,  $\times 40$ ).

tion has been.<sup>12,13</sup> Complete resection of the tumor prevents the insidious development of a permanent neurologic deficit and eliminates the potential risk of sarcomatous degeneration, which occurs in 1% of the solitary forms and in 5% to 15% of the multiple osteochondromas.<sup>1,18</sup>

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