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Case Report

Spinal fusion for postlaminectomy kyphosis following intramedullary spinal cord tumor resection: A 34-year follow-up

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ABSTRACT

Background: Resection of intramedullary spinal cord tumors (IMSCTs) in pediatric patients results in a high incidence of spinal deformity (i.e., kyphoscoliosis often requiring fusion). Here, a 6-year-old male underwent a spinal fusion to correct postlaminectomy thoracic kyphosis following resection of an IMSCT.

Case Description: A 6-year-old male initially underwent multilevel thoracic laminectomies for resection of an IMSCT. Six months later, he presented with the onset of kyphoscoliosis. During adolescence he became increasingly paraparetic due to a thoracic kyphosis that had now progressed to 118°. He underwent a 360 decompression/fusion that included a T1-T9 laminectomy, a T5 to T11 anterior interbody arthrodesis/rib autograft, and posterolateral T2-T12 fusion/iliac crest autograft with Harrington rods placed from T5 to T12. Postoperative radiographs showed the thoracic kyphosis improved to 62°. However, 4.5 years later, X-rays showed the thoracic kyphosis newly progressed to 90° (i.e., from T3 to T12). Thirty-four years after this corrective surgery, he remained neurologically intact with only mild complaints of balance changes, and bladder/bowel urgency while radiographs confirmed continued stability. Further, the thoracic magnetic resonance imaging showed only chronic thoracic spine/cord changes.

Conclusion: A 6-year-old child originally underwent a thoracic laminectomy for an IMSCT. As an adolescent, due to progressive postlaminectomy kyphosis, he underwent a successful secondary thoracic 360° decompression/fusion. Notably, 34 years later, he did not require any surgical revision.

Keywords: Cerebrospinal fluid, Intramedullary spinal cord tumor, Postlaminectomy kyphosis, Scoliosis, Kyphosis

INTRODUCTION

Intramedullary spinal cord tumors (IMSCTs) make up 2–5% of all primary spinal cord tumors; gliomas accounting for 80% of these lesions.[11] In children, astrocytomas make up nearly 60% of the World Health Organization (WHO) grades I/II cervical/thoracic (C/T) IMSCTs tumors, while with remaining 40% include WHO grade II C/T ependymomas.[6,11] Patients typically present with back or neck pain, and myelopathy/

paraparesis attributed to progressive kyphosis/deformity often warranting 360° decompressions/fusions.[6] Here, a 6-year-old male originally underwent a laminectomy for a IMSCT. However, by age 13, he required an extensive circumferential decompression/fusion for postlaminectomy kyphoscoliosis. Notably, 34 years later, he remained neurologically and radiographically stable.

CASE REPORT

Initial presentation

A 6-year-old male, diagnosed with a IMSCT, underwent an initial thoracic laminectomy and radiation therapy for partial tumor resection (i.e., "glioma"). Postoperatively, he was fully plegic with a T6 sensory level and thoracic kyphosis from T1 to T12 (45°). By 6.5 years of age, the scoliosis progressed [Table 1] for which he received a Milwaukee brace. He was neurologically intact until age 13 when the thoracic kyphosis progressed and he developed new bilateral lower extremity weakness (i.e., 4/5 proximal/distal) [Table 1].

Corrective surgery

After traction in a halo in a wheelchair, he underwent an anterior fusion (i.e. a thoracotomy with discectomies and interbody rib graft fusions from T5 to T11). Notably, 39 days later he underwent a circumferential decompression/fusion; T1 to T9 laminectomy/posterolateral T2-T12 fusion with iliac crest autograft, and placement of T5 to T12 Harrington rods (i.e., hooks of placed on the transverse processes of T5 through T7 and T10 through 12 bilaterally). A dural tear at the T6 level was immediately repaired intraoperatively. On postoperative day 8, the patient's cerebrospinal fluid leak resolved with conservative treatment and he was placed in a halo cast for several months. Postoperative radiographs showed continued improvement after both surgeries [Table 1].

Postoperative course

Nine months later, (i.e., age 13 years 9 mos.), he developed a wound dehiscence and required removal of the right-sided instrumentation with debridement followed by placement of a Milwaukee brace. At ages 18 and 23, he remained neurologically normal and the thoracic kyphosis had largely stabilized [Table 1]. At age 47, he presented with mild myelopathy and issues, bowel and bladder urgency and stable scoliosis [Table 1 and Figure 1]. The cervical and lumbar MR studies were negative. Notably, the thoracic magnetic resonance imaging showed an atrophic upper thoracic spinal cord, while the lower thoracic cord revealed an increased intramedullary T2 signal that extended to the conus [Figures 2 and 3]. As he was just mildly symptomatic, no further surgery was offered.

Table 1: Scoliosis progression.

Age (years)	Curve levels (apex at T12)	Scoliotic curve (°)	Thoracic kyphosis (°)
6	T1-T12	45	72
6.5	T9-L3	27	99
10	T9-L3		77
13	T3-T12		118
13 (post-anterior approach)	-		86
13 (post posterior approach)	-		62
18	T3-L12	38	90
47	T3-L12	31	82

Figure 1: Standing posteroanterior (left) and lateral (right) scoliosis plain films. There is a right-side scoliotic curve from T8 to L3 (apex at T12) of 31° and thoracic kyphosis from T3 to T12 of 82°. The size of the thoracic vertebral bodies appears small given the size of the lumbar vertebral bodies, and the thorax is proportionally small.

Table 2: Literature review of IMSCTs.

Author	Publication year	Summary of findings
Ahmed *et al.*	2014	• Long-term incidence of spinal deformity in 55 pediatric patients after surgery for IMSCTs • Preoperative deformity was present in 20% and new onset postoperative deformity was found in 16% • 55% required surgical fusion • Long-term follow-up is necessary after surgery for IMSCTS due to delayed development of spinal deformity
Ahmed *et al.*	2008	• Review on craniovertebral junction fusions: indication, technique, fixations, and outcome • Craniocervical stabilizations before age 5 does not result in abnormal spine growth • Rigid instrumentation preferred above age 10
de Jonge *et al.*	2005	• Retrospective study of 76 patients describing post-laminectomy/post-radiation spinal deformities and post treatment outcomes • 88% developed post laminectomy/post radiation spinal deformity • Preoperative application of distraction plaster cast reduces deformity • Rigid external immobilization recommended for 4 months in cervical spine and 6 months in thoracic spine after laminectomy/laminoplasty
Duman *et al.*	2012	• Case report of a 55-year-old woman who developed paraplegia due to post laminectomy kyphoscoliosis • Untreated postsurgical kyphoscoliosis can progress and lead to severe neurological complications
Hersh *et al.*	2017	• Retrospective study of 66 patients assessing need for surgical fusion after both laminectomy and laminoplasty • Patients in both cohorts had a similar rate of postoperative deformity • 15% required instrumented spinal fusion for deformity
Huisman	2009	• Review on pediatric tumors of the spine • Pediatric spinal cord neoplasms are rare with the most common type being astrocytoma • Symptoms are nonspecific leading to delay in diagnosis • MRI is the imaging modality of choice
Knafo *et al.*	2014	• Retrospective study of 63 patients on surgery for intramedullary tumors assessing difference between pre and post-operative Cobb angle • The mean sagittal deformity was 15.9° • A statistical tool was developed for surgical planning and to evaluate risk of sagittal spinal deformity
Papagelopoulos *et al.*	2015	• Retrospective study of 36 patients assessing long term outcome of multilevel thoracolumbar laminectomies for treatment of benign intraspinal tumors • 16.6% of pts had spinal deformity and 11% had spondylolisthesis after a mean follow up period of 14 years • Incidence of spinal deformity or instability may be reduced by limiting laminae remove and facet destruction
Spacca *et al.*	2015	• Retrospective study of 134 pediatric patients with spinal tumors • 117 pts were surgically treated and 3.7% developed spinal instability • Osteoplastic laminectomy is a reasonable approach with low risk of spinal instability

IMSCTs: Intramedullary spinal cord tumors

DISCUSSION

Pediatric surgery for IMSCT

Surgical resection is the mainstay of IMSCT treatment in the pediatric age group [Table 2]. However, this carries the risk for developing postlaminectomy spinal deformity/scoliosis (incidence 24–100%).[1,3,5,8,9] Children like the 6-year-old presented are at higher risk for spinal deformity largely due to; underlying ligamentous laxity, cartilage content, reduced paraspinal musculature support, horizontal orientation of facet joints, radiation therapy to an underdeveloped spine, and disproportionate load bearing due to the relative cranium to body mass ratio.[2,5,10]

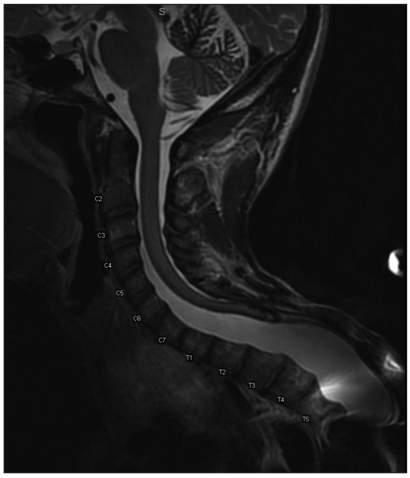

Figure 2: A T2-weighted sagittal magnetic resonance imaging of cervical and upper thoracic spine demonstrating dural ectasia in the upper thoracic spine associated with an apparent extensive laminectomy defect that begins at T2 and extends distally. The visualized thoracic spinal cord is markedly atretic and adherent to the posterior aspect of the thecal sac. There is considerable artifact from instrumentation at T6.

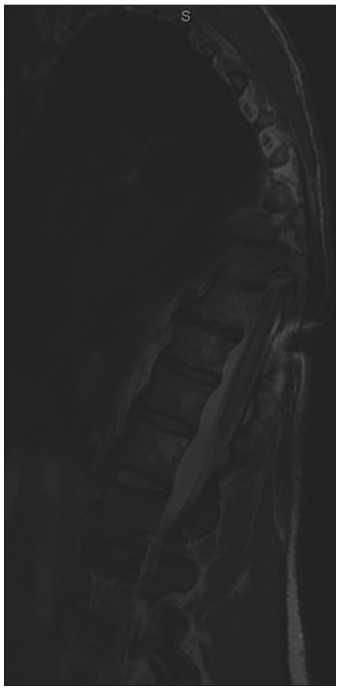

Figure 3: A T2-weighted sagittal magnetic resonance imaging of the thoracic spine demonstrating increased intramedullary T2 signal that extends to the conus medullaris. There is considerable artifact from instrumentation that obscures the mid- and most of the upper thoracic spine.

IMSCT resection in the pediatric population

Pediatric patients undergoing initial IMSCT resection for tumor recurrence/progression will typically demonstrate progressive postoperative kyphosis warranting posterolateral fusion. One study evaluated kyphoscoliosis resulting in paraplegia 42 years after a childhood laminectomy for a IMSCT.[4] Kelley *et al*.[7] recently reported success at 18 months following a resection of a IMSCT with multilevel thoracic pedicle subtraction osteotomy/fusion performed in a pediatric patient with post laminectomy kyphotic deformity.

CONCLUSION

A 6-year-old child underwent a thoracic laminectomy for an IMSCT requiring subsequent revision circumferential decompression/fusion. Notably, 34 years later, the patient presented with mild hyperreflexia and did not warrant repeated surgery.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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