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Long-level intramedullary spinal cord astrocytoma complicated with spine scoliosis: Report of two cases

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ABSTRACT

INTRODUCTION AND IMPORTANCE: Long-level intramedullary astrocytomas complicated with spine scoliosis are rare. Surgical treatment of such tumors becomes more complicated and challenging when spinal scoliosis is present. However, studies describing the treatment of long segmental intramedullary spinal cord astrocytomas complicated with severe spine scoliosis have been rarely reported.

CASE PRESENTATION: Two cases of long-level intramedullary astrocytomas complicated with severe spine scoliosis were surgically treated with one-stage operation of tumor resection and scoliosis correction in this report. Case 1: A 16-year-old boy presented to our hospital with a five-month progressive paresthesia, weakness of the left lower limb, and a long-time abnormal body appearance. MRI showed a T4-T12 intramedullary tumor combined with spinal scoliosis. Case 2: A 14-year-old boy presented at our service with a 6-year history of visible spine scoliosis and a 1-year progressive motor disability of bilateral lower limbs. Spine MRI indicated a long-level abnormal syringomyelia signal from C4 to L1 and there was irregular enhancement after intravenous contrast medium administration at C7-T2 and T9-T12 level.

DISCUSSION: We performed a laminectomy over the whole length of the tumor and corrected the scoliosis with trans-pedicle screws. The patients exhibited a long-time tumor free with largely neurological function preservation. One-stage operation did not generate severe short- or long-term complications. The correction of the scoliosis prevented the progression of the spinal deformity and facilitated the recovery of normal life.

CONCLUSION: This case report demonstrates that the one-stage resection of long-level intramedullary astrocytoma and correction of the complicated scoliosis might be a feasible option.

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1. Introduction

Gross total resection could be only achieved in approximately 31% of spinal cord intramedullary astrocytomas [1,2]. In several literatures, the extent of resection does not significantly influence the prognosis among patients with low-grade astrocytomas [3]. However, gross total resection of intramedullary astrocytomas was advocated to get long-time tumor free survival [1]. Tumors that involve more than 5 vertebral segments can be defined as long-level intramedullary tumors [4]. Surgical treatment of such long-level intramedullary tumors becomes more complicated and challenging, especially when spinal scoliosis present at the same time.

During the past 5 years, 176 cases of intramedullary spinal cord tumors were surgically resected in our single institute. Significantly, there were 2 cases of long-level intramedullary astrocytomas complicated with severe spine scoliosis (cobb angle > 50°). Thus far, there have been very few reports of single-stage surgical management of intramedullary tumors complicated with scoliosis. In this report, we present our experience of the surgical management of long-level intramedullary astrocytomas complicated with spine scoliosis. The operation was performed by the corresponding author, who had over 20 years of specialized surgical experiences. This report was guided by the Surgical Case Report (SCARE) guidelines [5].

2. Case presentation

2.1. Case one

A 16-year-old boy presented to our hospital with a five-month progressive paresthesia, weakness of the left lower limb, and a

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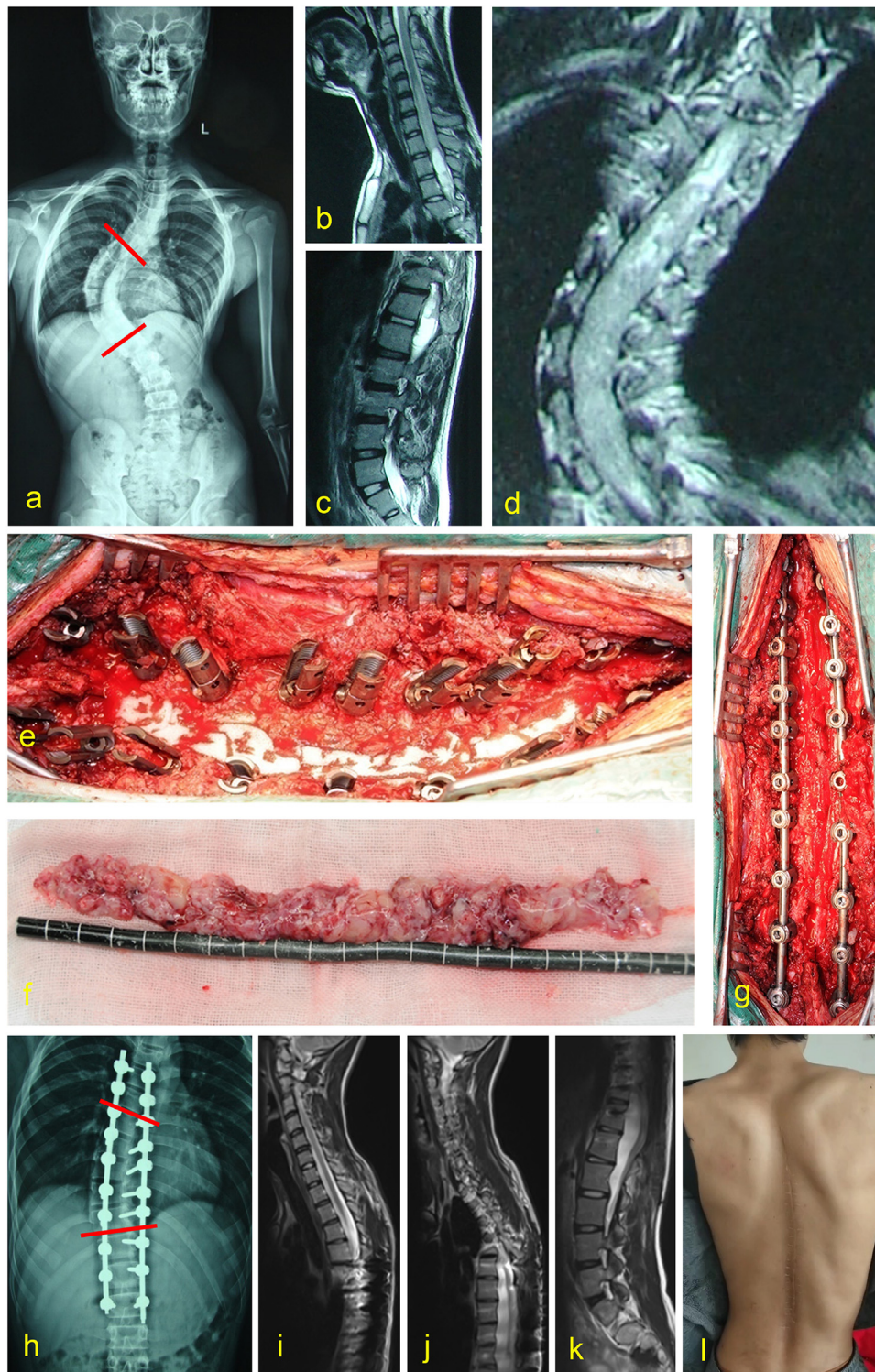


Fig. 1. Case 1. A 16-year boy diagnosed with intramedullary spinal cord tumors complicated with spine scoliosis. X-ray showed a thoracic scoliosis and the coronal Cobb angle was 80° (a). MRI indicated a T4-T12 intramedullary spinal cord tumor (b-d). Intraoperative images of the tumor excision and instrumented from T4-L1 (e). The intramedullary tumor is approximately 20 cm long (f). Intraoperative image after spinal orthosis (g). Postoperative X-ray showed that the spinal scoliosis was corrected, and the coronal Cobb angle was 28° (h). MRI showed no intramedullary tumor signal (i-k). The appearance of the body trunk was satisfactory at the 5-year follow-up (l).

long-time abnormal body appearance. Body examination revealed insensitivity below the left knee level. Muscle strength of the left lower limb was level 4/5. Pathologic reflexes of both lower limbs were positive. There were no sphincter defects. The Klekamp neurological score [6] was 17/20. The coronal Cobb angle of the spinal scoliosis was 80° (Fig. 1a). MRI showed a T4-T12 intramedullary

tumor combined with spinal scoliosis (Fig. 1b-d). No relevant drug history, family history or psychosocial history was found.

The patient was willing to accept the operation. Tumor resection and scoliosis correction surgery were performed. A midline approach was pursued from T4 to L1. Pedicle screws were firstly instrumented from the T4 to L1 segments bilaterally. A laminectomy

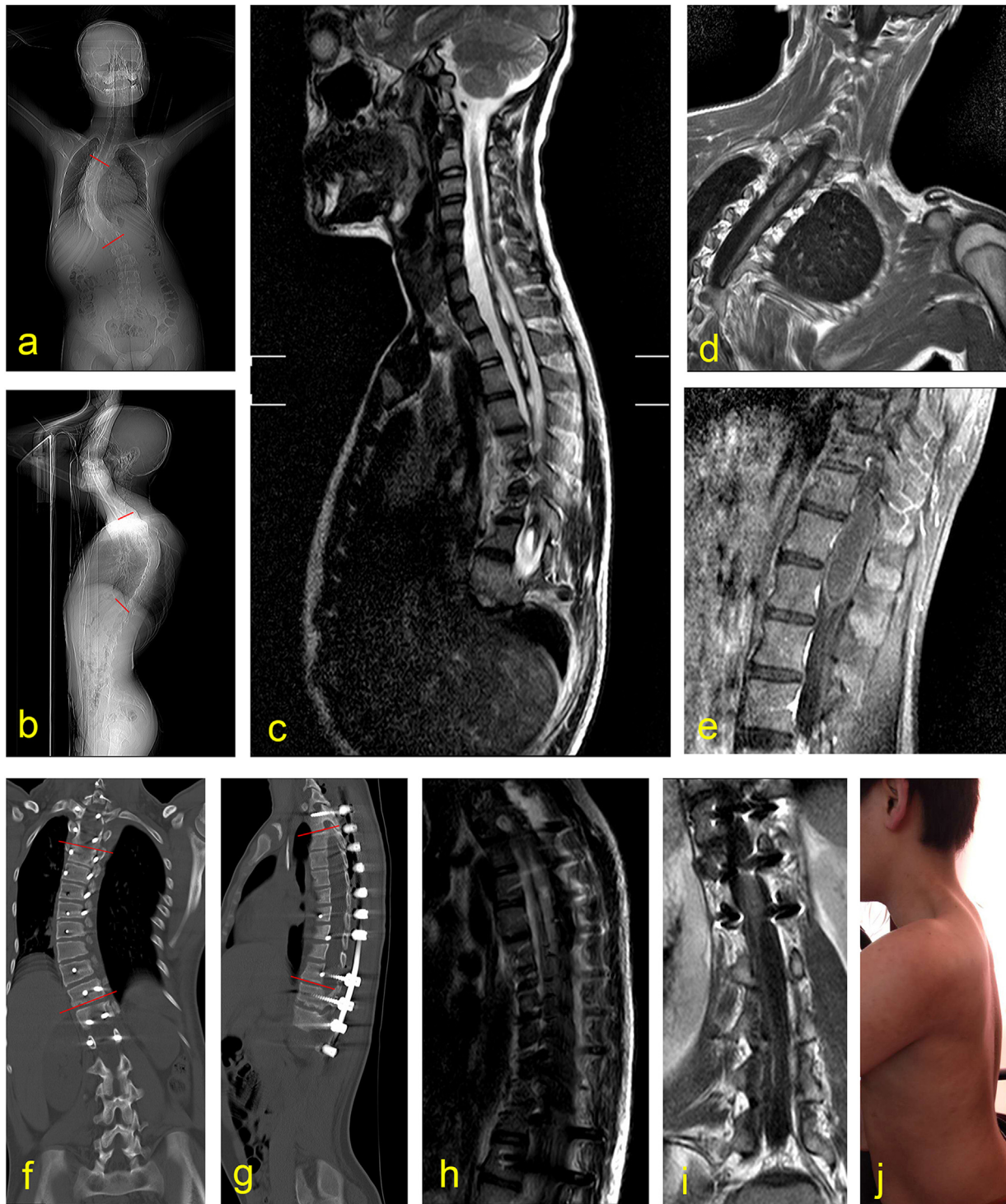


Fig. 2. Case 2. Preoperative images of a 14-year-old patient diagnosed with intramedullary tumors complicated with spine scoliosis. X-ray indicated spine scoliosis and the coronal Cobb angle was 66° with kyphosis angle of 77° (a-b). MRI showed a long-level intramedullary abnormal signal from C4-L1 (c-e). Postoperative CT scan demonstrating that the coronal Cobb angle was 33° ; the kyphosis angle was 30° (f-g). MR image indicating no obvious tumor signal (h-i). The patient's body appearance showed good correction of spinal deformity at the 4-year follow-up (j).

tomy was then administered from T4 to T12. After opening the dura, the yellowish-gray-colored tumor was identified under surgical microscope and proved by biopsy. Then the tumor was gross total resected piecemeal with sharp dissection to minimize the traction to normal spinal cord tissue during the resection (Fig. 1e). The tumor size was approximately $20 \times 2.5 \times 2.5$ cm (Fig. 1f). The spinal pia mater was discontinuously sutured and the spinal dura was watertight sutured. The correction was performed by two molded

rods which connected from T4 to L1. He also underwent a posterior spinal fusion from T4 to L1 (Fig. 1g). The whole operation lasted 8.25 h, with approximately 1600 mL blood loss. Autotransfusion was 750 mL, allogeneic erythrocyte transfusion was 400 mL, and allogeneic plasma transfusion was 400 mL. Somatosensory and motor evoked potentials were used as usual. The pathology results indicated WHO II astrocytoma.

Two weeks after the operation, the patient's muscle strength of the left lower limb was level 3/5, and the right lower limb was level 2/5. After performing rehabilitation exercise, the patient was able to return to normal activities 1.5 years after surgery. The postoperative coronal Cobb angle was 28° (Fig. 1h). No remnant tumor was observed (Fig. 1i–k). At the latest 5-year follow-up point after surgery, there was no evidence of tumor recurrence. The appearance of the body trunk was satisfactory (Fig. 1l). The Klekamp neurological score was 17/20. The patient was satisfied with the results.

2.2. Case two

A 14-year-old boy presented at our service with a 6-year history of visible spine scoliosis and a 1-year progressive motor disability of bilateral lower limbs. The muscle strength of both lower limbs was level 4/5. Hyperreflexia and pathologic reflexes were positive. There were no obvious signs of neurological damage to the upper limbs. The Klekamp neurological score was 18/20. X-ray images showed a severe scoliosis, with a coronal Cobb angle of 66° and a kyphosis angle of 77° (Fig. 2a–b). Spine MRI indicated a long-level abnormal syringomyelia signal from C4 to L1 and there was irregular enhancement after intravenous contrast medium administration at C7–T2 and T9–T12 level (Fig. 2c–e). No relevant drug history, family history or psychosocial history was found.

The patient was willing to accept and underwent removal of the tumor and scoliosis correction. Through a midline incision over the C7–L2 level. Pedicle screws were instrumented at the T2 to L1 level bilaterally. A laminectomy was then administered from C7–T2 and T9–T12 respectively. The dura was opened and over-hunged on both sides to prevent venous bleeding as usual. Two intramedullary tumors approximately 1.5 × 1 × 1 cm and 2.5 × 1.5 × 1.5 cm in size were gross total resected piecemeal. The spinal pia mater and the spinal dura was sutured as previous description. Two titanium rods were molded and fixed from T2–L1 to correct the spinal deformity. Posterior spinal fusion was performed from T2–L1. The whole operation lasted 9.3 h, with approximately 2000 mL blood loss. Autotransfusion was 1000 mL, allogeneic erythrocytes transfusion was 400 mL, and allogeneic plasma transfusion was 400 mL. Somatosensory and motor evoked potentials were monitored. The pathology result indicated WHO II astrocytoma.

Two weeks after surgery, the muscle strength of the lower limbs was approximately level 2/5. The correction rate of scoliosis was about 50% with the kyphosis angle of 30° (Fig. 2f–g). MRI showed postoperative syringomyelia with no tumor recurrence (Fig. 2h–i) at 4-year follow up. The muscle strength of the lower limbs exhibited some improvement, measuring level 3/5 of the left and level 4/5 of the right after 4 years of rehabilitation exercise. The patient was able to walk with assistance equipment. The Klekamp neurological score was 16/20. The appearance of the deformity correction was pleasing (Fig. 2j). The patient was satisfied with the results.

3. Discussion

Astrocytomas are the most common intramedullary tumors in children [7]. Astrocytomas are infiltrating tumors. The goal of the treatment is to reduce the tumor size as much as possible. Complete resection of astrocytoma can be defined as no visible tumor left intraoperatively and on postoperative MRI. Radical resection increases the overall survival in focal malignant astrocytomas [8]. Aggressive surgery is associated with a prolonged survival for patients with intramedullary astrocytomas [9]. In previous reports, the prevalence of spine deformity on presentation was about 20%–33% in patients with intramedullary spinal cord tumors [10–12]. The underlying neuromuscular dysfunction might be part

of the reason. The irreversible changes in musculoskeletal function may also aggravate postoperative spine scoliosis [12].

In this report, two intramedullary astrocytomas were both completely gross resected (no visible tumor left intraoperatively and on postoperative MRI), and the tumors were pathologically diagnosed as WHO II grade astrocytoma. We did not suggest postoperative adjuvant radiotherapy for these two patients. Postoperative adjuvant radiotherapy has demonstrated decreased recurrence of high-grade astrocytoma, while it is controversial for low-grade gliomas [9,13,14]. These two patients exhibited obvious severe scoliosis at the first diagnosis of the intramedullary tumor. To achieve gross total resection of the tumor and correcting spinal deformity, we performed a long-level laminectomy over the whole length of the tumor and corrected the scoliosis with trans-pedicle screws after total resection of the tumor at the same time. The complex nature of the surgical procedures did not generate severe short- or long-term complications. The neurological function recovery was related to total resection of the tumor. It is not definite whether the correction of the scoliosis may be beneficial to the postoperative neurological function. If nothing else, the correction of the scoliosis prevented the progression of the spinal deformity and facilitated the recovery of normal life.

During the single-stage surgical plan of the two intramedullary astrocytomas complicated with scoliosis cases, we encountered another problem of whether we should resect the tumor first or perform the scoliosis correction first. Theoretically, to perform the scoliosis correction first could allow the tumor resection to proceed as usual, but we could not control the possible negative effects of the tumor on the normal spinal cord during the correction. Therefore, we chose to perform the tumor resection first. The laminectomy in advance could facilitate the correction of the scoliosis.

Our experience with the two intramedullary astrocytomas complicated with spine scoliosis patients showed some positive indications that the gross total resection of long-level intramedullary WHO II grade astrocytoma could result in a long-time tumor free with largely neurological function preservation. The single-stage resection of the tumor and correction of the complicated scoliosis did not add extra complications. During surgical management of the long-level intramedullary spinal cord tumors complicated with severe scoliosis, careful preoperative evaluation, experienced skills and hard work of a team are required to achieve a satisfactory result.

4. Conclusion

The prognosis of the patients showed that the gross total resection of long-level intramedullary WHO II grade astrocytoma could result in a long-time tumor free with largely neurological function preservation. The spine deformity was largely corrected with no aggravation. The one-stage resection of long-level intramedullary tumor and correction of the complicated scoliosis might be a feasible option.

Declaration of Competing Interest

The authors report no declarations of interest.

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Ethical approval

The paper is a case report, and therefore does not require ethics approval.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images.

Author contribution

Dongao Zhang: Data curation and Writing - original draft.
Wayne Fan: Investigation.
Xingang Zhao: Methodology.
Eric M. Massicotte: Writing - review.
Tao Fan: Conceptualization, Funding acquisition, Supervision.

Registration of research studies

Not applicable.

Guarantor

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