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A clinical case of surgical treatment of severe congenital kyphoscoliosis in an 11-year old child

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Study Design Presentation of a clinical case. **Object** A clinical case of severe congenital kyphoscoliosis in an11-year-old child treated surgically. **Method** Vertebrotomy beyond the anomaly zone with the PSO technique and dynamic fixation of the spine. **Result** Correction of spinal deformity. **Discussion** Surgical treatment of congenital kyphoscoliosis with the PSO technique out the zone of congenital anomaly and implantation of dynamic systems achieve an orthopedic goal with a single intervention via a single approach.
Keywords: congenital scoliosis, children, pedicular vertebrotomy, dynamic fixation of the spine, hemivertebra

CLINICAL RELEVANCE

Congenital deformities of the spine are a group of spine curvatures in the formation of which the leading role belongs to vertebral anomalies. Their proportion in all curvatures of the spine is about 2.5 % [1]. The dysplastic course of congenital scoliosis frequently results in complex deformities of the vertebral column with a multi-plane rotation of vertebrae, development of secondary arcs of the curvature beyond the abnormality zone in the type of the "crankshaft" phenomenon [2]. At the moment, the tactics of treating children with this pathology that have a great potential of further growth has been not completely defined and is controversial. "Growing systems" have been frequently used in children until the end of bone growth (Risser test 4–5) [3] and local fixation with extirpation of the hemi-vertebra [4–9]. We bring to your attention a clinical case as an example of treating patients with this pathology.

Case description

An 11-year old girl was admitted to the pediatric neurovertebrology department of the RISC for RTO on 09.02.2016 with a progressive deformity in the thoracic spine and stiff neck.

Anamnesis The defective formation of the spine was detected in the early childhood. Conservative therapy such as orthopaedic massage, corrective measures and exercise therapy was used for treatment but the deformity continued progressing.

Her orthopaedic status was S-shaped scoliosis of the cervical and thoracic spine, asymmetry of shoulders and scapulas, with the right one standing 1 cm higher. The movements in the cervico-thoracic spine were in full volume.

Her neurologic status was class E according to ASIA.

Radiographic telemetry showed congenital scoliosis due to lateral hemivertebrae in the cervical and thoracic spine. The main anomaly was disorder in formation and segmentation of the vertebrae, S-shaped combined kyphoscoliotic curve of C6–Th2 with the apex of the deformity at C7 level: scoliotic component was 46° (Cobb), local kyphosis at Th3–6–10 level was 43°. Thoracic scoliotic curve in Th3-Th11 with the apex at the Th5 hemivertebra (relatively) measured 46° (**Fig. 1**).

Spine MSCT findings were congenital anomaly with lateral unsegmented wedge-shaped hemivertebrae C7 and Th5 from the left side (**Fig. 2**).

On the basis of clinical examination and radiological imaging, she was diagnosed with congenital progressive kyphoscoliosis of severe grade (according to James) due to unsegmented lateral C7 and Th5 hemivertebrae and dysplastic course of the caudal counter curve.

Indication to surgical intervention: congenital kyphoscoliotic deformity with a high potential to progress

Surgery was performed on 10.02.2016: asymmetric PSO at Th1 level, dorsal transpedicular fixation with a dynamic type system, correction of the deformity. All the procedures ran under neurophysiological control.

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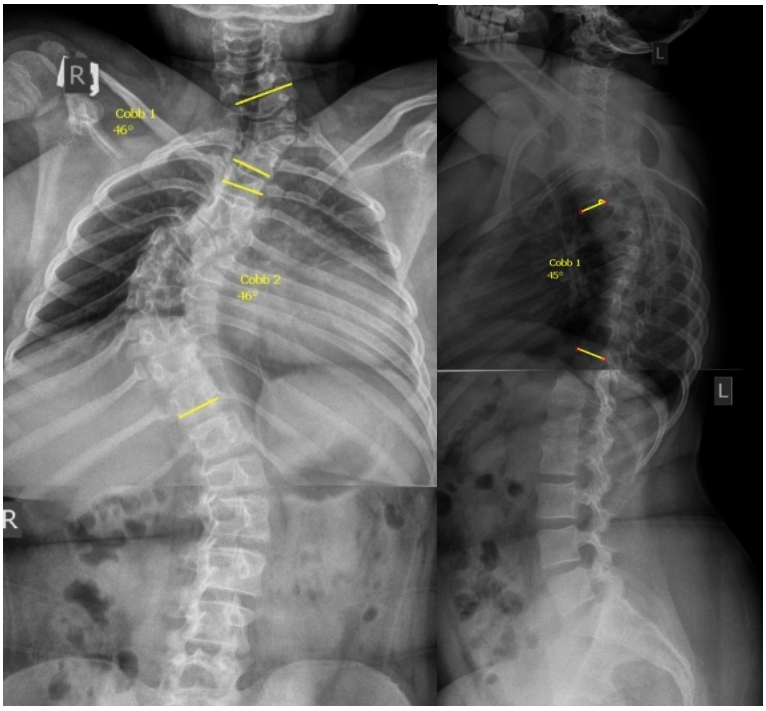

Fig. 1 Radiographs of 11-year old patient spine with congenital S-shaped kyphoscoliosis with lateral hemivertebrae in the cervical and thoracic spine; leading defect is a disorder in vertebral formation, S-shaped combined kyphoscoliotic curve C6-Th2 with the apex at the level of C7 hemivertebra (relative): scoliotic component – 46 ° Cobb, local kyphosis at the level of Th3–6–10 – 43°. Thoracic scoliotic curve Th3–Th11 with the apex at the level of Th5 hemivertebra (relatively) – 46°

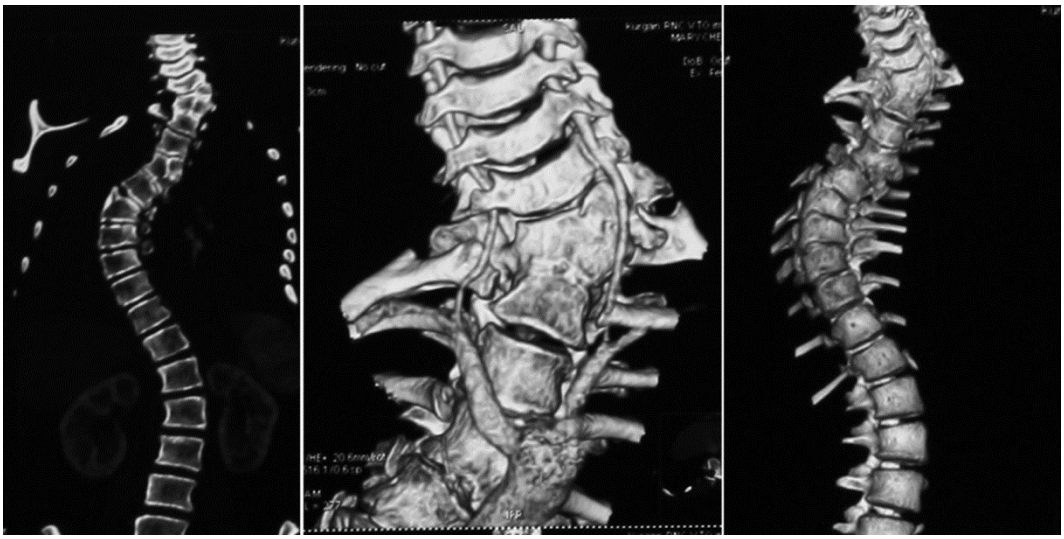

Fig. 2 CT image of the defect in the sagittal slice and by multispiral 3D reconstruction

Operation protocol Mayfield system was mounted. The operation field was treated three times and then a linear skin and soft tissue incision was made in the projection of the osseous processes at C5–Th4 level. The posterior column was exposed and union of vertebral arches was observed. Support elements were placed transpedicular and intracorporal into the C7 hemivertebrae, and vertebrae C7, Th2–3 on the left and Th2–3 on the right. Image intensifier control followed and showed a proper placement of the metal components.

After triple treatment of the operation field, skin and soft tissue incision was made along the line of the osseous processes at Th12–L2 level and the posterior column was exposed. Bilateral support elements were implanted transpedicularly and intracorporal in Th12, L1, L2. Image control showed the proper placement of the metal components. Extensive Th1 laminectomy was performed. The dural sac had a physiological colour and pulsed; the epidural veins on the convex side were hypertrophic. Asymmetric PSO at Th1 level was performed. There were no sign for spinal cord compression to occur. Rods were mounted in the mode of deformity correction. There was reduction in the intervertebral space (IVS) on the right. Upon completion of all the manipulations, IVSs were completely restored. Image control showed 80 % of deformity correction

(**Fig. 3**). Nuts were tightened. The dural sac was not folded and pulsed. Spinal cord decompression and deformity correction were performed under neuromonitoring control and protective intravenous methyl prednisolon infusion. Autologous bone fragments were used for posterior spondylodesis at Th1 level. Hemostasis control and wound suturing by layers followed. Redon draining was applied bilaterally. Intradermal stitching and aseptic dressing completed the surgery. Total blood loss was 100 ml.

Postoperative period ran smoothly. The wound healed by primary intention.

Postoperative radiographs of the thoracic spine showed correction of the deformity within 75 % and correct position of instrumentation elements (**Fig. 4**).

Neurological status in the postoperative period showed no negative dynamics. The child was verticalized on day 3 and wore a semi-rigid chest-lumbar brace of a "disciplinary type". The patient was discharged on February 19, 2016 on the 10th day post surgery.

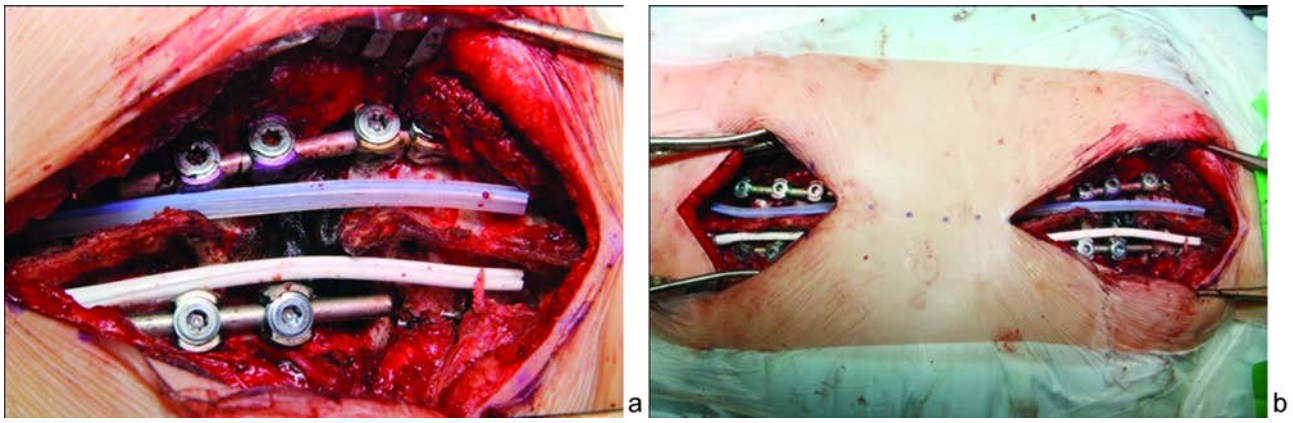

Fig. 3 Intraoperative image: (**a**) a wound after asymmetric PSO of Th1vertebra and installation of metal implants; (**b**) surgical wounds after implantation of instrumentation

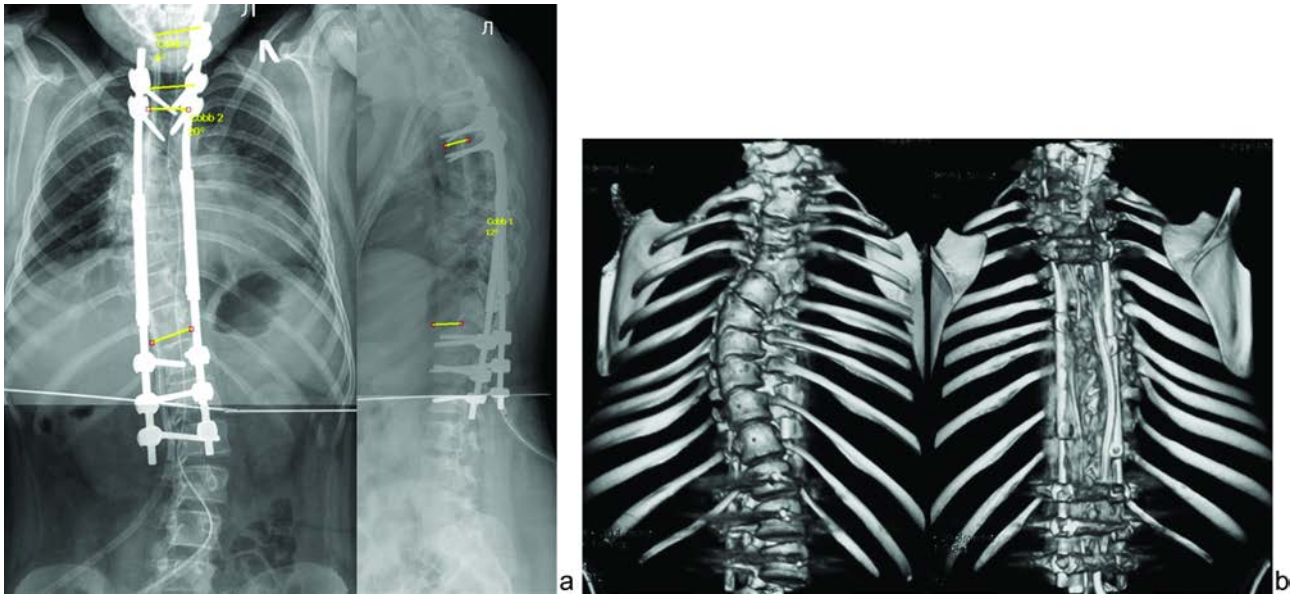

Fig. 4 Radiographs (**a**) and CT (**b**) of the thoracolumbar spine of the patient, 11 years old, after the operation. S-shaped combined kyphoscoliotic C6–Th2 curve with apex at the level of C7 hemivertebra (relatively): scoliotic component – 6° (Cobb), local kyphosis at Th3–6–10 – 12°. The thoracic scoliotic curve Th3-Th11 with the apex at the level of Th5 hemivertebra (relatively) – 20°

DISCUSSION

The technique of osteotomy beyond the anomaly zone by the method of pedicular vertebrotomy with correction of congenital deformity by means of adjacent segments has been applied at the department of pediatric neurovertebrology at the RISC for RTO for 3 years. Also, the dynamic instrumentation has been widely used in small children with a large growth potential. In this case, we combined these two techniques. One of the main merits of the described technique is the possibility to perform osteotomy beyond the zone of developmental anomaly, as a safer one, and the possibility of both local and extended correction of congenital deformities of the

spine. Simultaneous implementation also determines the reduction in the volume of blood loss and in surgical intervention time. However, the use of such an operation undoubtedly requires a highly qualified surgeon, equipping the operation room with power and bone sets, and availability of intraoperative fluoroscopy and neuromonitoring in the clinic. The experience of using this operation procedure enables to apply the method of asymmetric pedicle vertebrotomy beyond the anomaly zone with the placement of a dynamic "growing" transpedicular fixation system, including for correction of severe congenital kyphoscoliotic deformity.

In the case presented by us, an asymmetric PSO type of vertebrotomy was not performed at the apex of deformity but more caudal. It enabled to preserve more cervical segments mobile and to reduce the likelihood of postoperative neurological complications. The dynamic system made it possible to correct the deformity at this stage of the child's development with a possibility of further control of the deformity by means of step-wise corrections until the growth is complete. It significantly reduces the risks of deformity progression and secondary complications associated with it.

CONCLUSIONS

Surgical treatment of congenital kyphoscoliosis using the PSO method out of the zone of developmental anomaly and dynamic systems enables to solve the orthopedic problem for one surgical session from two local dorsal approaches. At the same time, the volume of surgical aggression and blood loss significantly decrease. It provides an early activation and verticalization of the patient, and also a possibility to follow up the child until the end of bone growth.

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