SHORTENING VERTEBROTOMY IN CHILDREN WITH TETHERED CORD SYNDROME

E.A. Khodykin[1], K.V. Sysoev[1], E.V. Ulrikh[1, 2], W.A. Khachatryan[1]
[1]Polenov Russian Scienific Research Institute of Neurosurgery, St. Petersburg, Russia
[2]St. Petersburg State Pediatric Medical University, St. Petersburg, Russia

Shortening vertebrotomy was proposed as an alternative method of surgical treatment for the recurrent tethered cord syndrome (TCS) in adults. Our clinical observation demonstrated regression of clinical manifestations of the disease after shortening vertebrotomy in a child with recurrent TCS. It is shown that shortening vertebrotomy may be the method of choice in the treatment of children with this disease when additional indications exist.
Key Words: tethered cord syndrome, surgical treatment, shortening vertebrotomy.

Please cite this paper as: *Khodykin EA, Sysoev KV, Ulrikh EV, Khachatryan WA. Shortening vertebrotomy in children with tethered cord syndrome. Hir. Pozvonoc. 2016;13(1):37–40. In Russian.*
DOI: http://dx.doi.org/10.14531/ss2016.1.37-40.

Tethered cord syndrome (TCS) is a complex of functional disorders caused by spinal cord tension due to tethering of its caudal part in the lumbosacral spinal canal. The clinical constellation of signs and symptoms associated with TCS may include neurological, orthopedic and urological findings. The most common findings include motor and sensory deficits in the lower extremities, dysfunction of pelvic organs, and pain syndrome [3]. The main purpose of surgical treatment of TCS is to release the structures of spinal cord from excessive tension. The traditional method of TCS treatment in patients with spinal dysraphic lesions involves microsurgical elimination of tethering factors (lipomas, dermoid cysts, bone and/or fibrous walls of the vertebral canal and others), removal of the arachnoid scars and adhesions, and excision of the filum terminale [2, 9]. In the cases of recurrent TCS surgical manipulations raise the risk of damage of spinal cord and its roots and in some cases tethered cord release is impossible [5]. Kokubun [7] proposed the shortening vertebrotomy as an alternative to microsurgical treatment for the recurrent tethered cord syndrome in adults. Shortening of 15–25 mm of height in the spinal column has been shown to be comparable in efficacy with tethering release of no less than 90 % in microsurgical intervention [4]. Usual indications for shortening vertebrotomy are deformities of the spine with fractures and neoplasms involving the spine [1]. According to Hsieh et al. [6], the shortening vertebrotomy can be indicated only to adults with recurrent TCS that are not accompanied by extra negative mechanical exposures on the spinal cord (compression, deformation and others). There are no reports of using shortening vertebrotomy in children with TCS.

Patient T., a boy aged 6 with history of myelomeningocele repair at the age of 7 months in the lumbosacral spine was examined. After surgery complaints were lumbar pain, leg weakness, urinary and fecal incontinence. MRI showed spine and spinal cord malformations: type II split cord malformation at L_2 level, cone position was low (at the L_5 vertebra level). On admission the patient complained of lumbar pain, numbness, weakness in the legs, abnormal gait (walking with the feet turned out, often falls), and intermittent urinary and fecal incontinence. The clinical presentation of the disease included lower flaccid paraparesis, hypotrophy, mainly in the adductor muscles of the hip, hypesthesia distal to the L_1 dermatome level, pain syndrome, infringement of functions of pelvic organs for peripheral type. Hypertrichosis was noted in the lumbar region in the projection of the L_2 vertebra. Multi-layer spiral CT of the spine revealed *spina bifida* at L5–S1, butterfly L_2 vertebra, scoliotic spinal deformity. MRI revealed postoperative changes, tethered spinal cord at L5–S1 level, type II split cord malformation at L2 level (Fig. 1). Based on the pain syndrome and deformity of the spine most likely associated with the instability on the tethering site in the region of the anomaly, it was decided to perform firstly shortening vertebrotomy through transpedicular L_2 vertebra resection with transpedicular fixation at T12–L4 levels (Fig. 2).

Patient lied with stomach on the bed. A skin was incised at the level of T11–L5 spinous processes. The lamina of the

spinous processes and arches of T12–L4 vertebrae was removed. Polyaxial screws were inserted in the T12, L1, L3, L4 vertebral arches under image intensifier control. Laminotomy at the L2 level was performed. The bilateral transpedicular approach at L2 was used for L2 resection with thin spoon-shaped instrument curettage. Curettage of the adjacent discs was performed. The transverse and articular processes were removed. The bone chips were placed in the formed defect. Contraction device comprised longitudinal fixed connectors (contraction was at least 20 mm). The dura mater is normal. The spinous process and medial parts of the L_2 vertebral arches were placed back, fixated to the adjacent arches of the vertebrae with bone fusion. A transverse connector was installed. The wound was sutured layer-by-layer. Aseptic bandage was adhered. Somatosensory and motor invoked potentials were monitored at all stages of the operation.

The postoperative period was characterized by a positive dynamics: pain regression, increase in muscle strength of the lower limbs, better control over bowel and bladder functions. Control MSCT of the spine showed full correction of the deformity (Fig. 3). The outcomes of surgical treatment were observed within 2 years of follow-up after surgery.

TCS is thought to be result from spinal cord stretching that causes violation of metabolism and electrical impulse conduction in the caudal cord [10]. There are opinions that shortening of the height of the vertebral column in patients with TCS may reduce spinal cord tension and lead to regression of clinical manifestations [4, 7]. In our case, the child aged 6 years had a combination of congenital abnormalities of the spine and spinal cord. Type II split cord malformation at L2 level was observed that apparently caused weakness mainly in the adductor muscles of the hip and also caused spinal cord tethering at the proximal level. Secondary postoperative changes were observed at the L5–S1 level causing deformation and a distally tethered caudal spinal cord. The positive outcome after the operation evident in improved control of pelvic functions resulting from the shortening of the spine rather than from spinal cord mobilization supports the significance of tension in the pathogenesis of TCS. The main obstacle to the use of shortening resection (osteotomy) of the spine in children as an alternative to microsurgical revision of the spinal cord is the complexity of the surgery and false fear to disturb the growth of the spine. However, the removal of one abnormal segment does not affect the growth of the spine in general [8]. The operation will be less complicated and safer when the full team of neurosurgeons, orthopaedic surgeons and vertebrologists is involved and the operation is performed with the intraoperative neurophysiological monitoring.

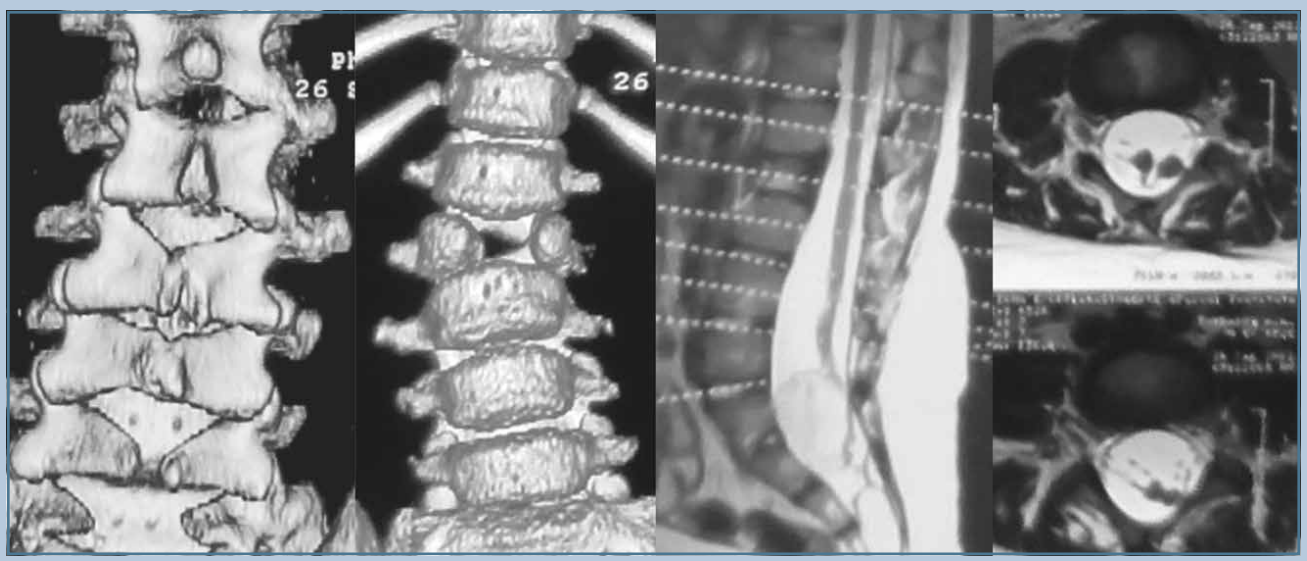

Fig. 1
MSCT and MRI of the spine of the patient T. aged 6 years: *spina bifida* L5–S1, butterfly L2 vertebra; T2Sag: spinal cord tethering and postoperative changes in the L5–S1 level, split cord malformation at L2 level

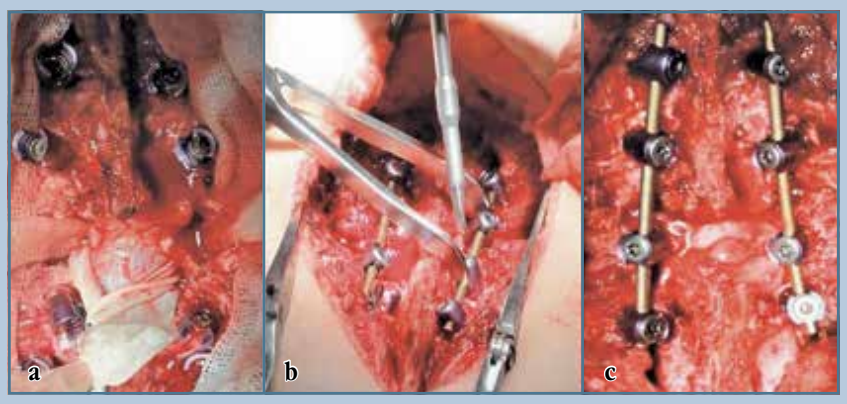

Fig. 2
Operation: **a** – transpedicular L2 vertebral body resection, installed screws into the support vertebrae; **b** – contraction; **c** – the fixation of longitudinal connectors fixated on the contraction and almost completely shortened interarch diastasis

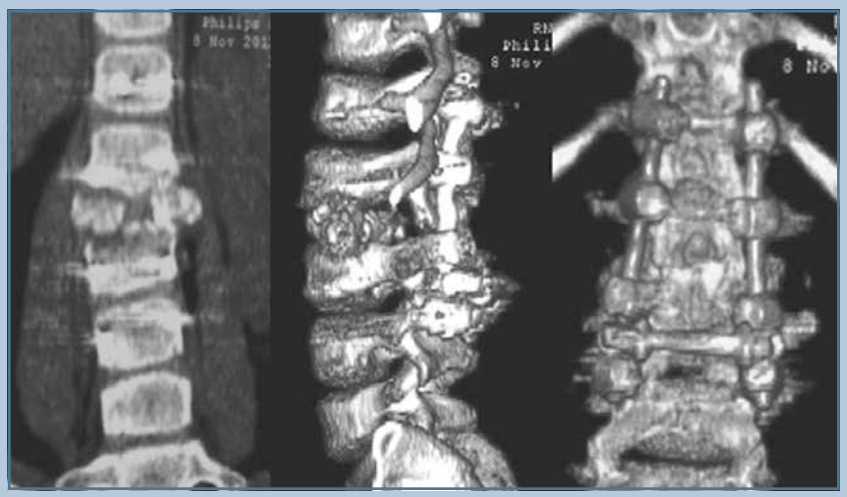

Fig. 3
Control MSCT

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Address correspondence to:
Khodykin Evgeny Alekseyevich
Polenov Neurosurgical Institute,
Mayakovskogo str., 12, St. Petersburg, 191014, Russia,
hodykin2010@yandex.ru

Received 03.11.2015

Evgeny Alekseyevich Khodykin, MD, neurosurgeon, Polenov Russian Scienific Research Institute of Neurosurgery, St. Petersburg, Russia;
Kirill Vladimirovich Sysoev, MD fellow, neurosurgeon, Polenov Russian Scienific Research Institute of Neurosurgery, St. Petersburg, Russia;
William Aramovich Khachatryan, MD, DMSc, Prof., Head of the Department of Pediatric Neurosurgery, Polenov Russian Scienific Research Institute of Neurosurgery, St. Petersburg, Russia;
Eduard Vladimirovich Ulrikh, MD, DMSc, Prof., Department of Pediatric Surgery, St. Petersburg State Pediatric Medical University, St. Petersburg, Russia, academic adviser, Polenov Russian Scienific Research Institute of Neurosurgery, St. Petersburg, Russia.