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CLINICAL AND NEUROIMAGING EXAMINATION 3-TL MR TRACTOGRAPHY OF CAUDAL PARTS OF THE SPINAL CORD IN VARIOUS FORMS OF SPINAL DYSRAPHISMS IN CHILDREN

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Annotation: One of the urgent problems of pediatric neurosurgery is the development of effective algorithms for the treatment of fixed spinal cord syndrome, characterized as a set of sensitive, motor, trophic disorders in the lower extremities, musculoskeletal deformities, pelvic and other disorders of varying severity, developing as a result of immobilization and tension of the caudal spinal cord during periods of accelerated growth of a child with spinal dysraphy, as well as due to scar-adhesive, inflammatory or tumor process.

Key words: fixed spinal cord syndrome, end-thread abnormalities, cicatricial-adhesive inflammatory process.

Introduction. Information on the number of patients with the "classic" fixed spinal cord syndrome caused by end-thread abnormalities (inelastic, thickened, shortened end-thread, end-thread lipoma) is contained in only one study, the results of which suggest that such patients make up no more than 0.1% of the population. The frequency of neural tube defects, in which stretching and deformation of the terminal parts of the spinal cord are noted, is at least 1 case per 1000 newborns. Taking into account the significant differences in the etiology and mechanisms of development of the fixed spinal cord syndrome, the motor level recognizes that it is advisable to clarify the fractional anisotropy of the receptors that affect the prognosis of its surgical treatment. In particular, there is an obvious need to identify structural changes in the spinal cord pathways.

The purpose of the study: to study the indications for surgery and the development of effective algorithms for surgical treatment of fixed spinal cord syndrome, we compared the data of spinal 3Tl MRI tractography with data obtained during clinical and neurophysiological examination of children with end-thread abnormalities and caudal lipomas, as well as patients with secondary scar fixation of the spinal cord that developed after correction of myelomeningocele (MMC) of the lumbosacral region.

Research materials and methods: The analysis of the results of examination and treatment of 42 adolescents aged 15 to 17 years was carried out. Clinical, electrophysiological, neuroimaging manifestations of the disease and their dynamics after surgery were evaluated. Considering that one of the main fractional anisotropy factors determining the quality of life and the degree of social adaptation of children with fixed spinal cord syndrome is the level of motor deficiency, to objectify the data of clinical examination before and after surgery, the functional motor level of all patients was evaluated.To this end, neurological examination revealed the most proximal level of the spinal cord, at which muscle strength in the lower extremities was at least 3 out of 5 points on the MRC (Medical Research Council) scale. A more proximal lesion level was taken into account in the study of the motor level of patients with asymmetric motor deficiency. There were groups of patients who completely lacked voluntary movements in the lower extremities (motor level Th), flexion and reduction in the hip joints (motor level L1-L2), extension in the knee joints (motor level l3-l4), extension in the ankle joints (motor level l4-l5), as well as patients in whom all voluntary movements in the lower extremities were preserved, but weakness of the flexors of the shin or foot (motor level S) was revealed. Before and after surgery, motor evoked potentials (DVP) were recorded from the muscles of the lower extremities (m. rectus femoris, m. tibialis anterior, m. gastrocnemius). The amplitude and latency of motor

responses were evaluated. The standard MRI examination was supplemented by tractography of the caudal spinal cord. The study was carried out on a high-field (3Tl) magnetic tomograph, a 15-channel spinal coil was used, parallel visualization, and the fractional anisotropy of the CT motor level was 2.0. The sequence parameters were TE/TR 60/6247, the slice thickness was 2, the distance between the motor level of the slices was 0, the number of slices and the field of view varied depending on the child's height. The number of repetitions is 2, the maximum b-fractional anisotropy of ktor is 800.

Postprocessing was carried out at the Extended mr workspace station (version 2.6.3.4) using the Fibertrac software package and consisted in automatic generation of fractional anisotropy maps in three orthogonal planes and the construction of paths. The level of tract interruption (the level of tract interruption) was determined on tractograms, and the average numerical values of fractional anisotropy were estimated to be proximal to the level of tract interruption. For children under 5 years of age, the study was conducted under conditions of drug sedation and analgesia. Communication F.A. and the age of the child was investigated by regression and correlation analysis (Pearson correlation analysis). To identify the dependence of fractional anisotropy on the motor level and the level of tract interruption, the Kruskal-Wallis criterion (H) was determined. A prognostic test was performed to identify sensitivity. The SPSS 22 software package for Windows was used for statistical processing.

The results of the study: According to the results of clinical and introscopic comparison, two groups of motor levels were identified. Group 1 included 10 sick children with end-thread abnormalities with dimelination of the ponytail and filium terminal terminalis, enuresis occurs in children. The characteristic clinical manifestations in these patients were moderate sensory and motor disorders that did not correspond to certain myotomas and dermatomas, as well as uniform suppression of tendon reflexes, dysregulation of pelvic functions (paroxysmal incontinence, delay), progressive scoliotic deformity of the spine, shortening of one of the lower extremities, accompanied by foot deformity of the "hollow foot" type (shortening, high arch of the foot). The development of clinical symptoms was associated with periods of accelerated growth of children. According to introscopy data, despite the low location and signs of spinal cord fixation, no changes in the spinal cord pathways were detected in this group of patients, the indicators of fractional anisotropy were in the range of 0.373-0.556.

Propriospinal connections ensure coordinated motor activity (walking) by distributing supraspinal stimuli to the motor level by motor neurons activating antagonist muscles. Impaired motor function of the lower extremities in children with various forms of spinal dysraphy may be congenital, develop as a result of stretching, compression or deformation of the spinal cord, and also worsen as a result of orthotic exposure and scar-adhesive changes as a result of surgical interventions on the spinal cord. Despite the fact that due to their viscoelastic properties, the axons of neurons are resistant even to significant mechanical influences, including stretching, there is reason to believe that long conductors and short propriospinal fibers react differently to them. The result of the tension of the latter can be both a violation of function and irreversible changes leading to degeneration of nerve fibers. A decrease in fractional anisotropy in spinal cord injury is believed to be associated with rupture of longitudinally oriented axons of white matter. The absence of pathological changes on the part of the spinal cord conductors in patients with end-thread lipoma suggests stretching as an isolated fractional anisotropy of the effect on the spinal cord, and the clinical manifestations of this pathology can be characterized as fixed spinal cord syndrome. Displacement and deformation of the conductors with a minimal decrease in fractional anisotropy at the level of invasion by tumor tissue in patients with spinal cord cone lipoma indicate additional, but not critical, mechanical effects. In our opinion, the sudden interruption of tracts detected in patients with the consequences of eliminating myelomeningocele in the absence of a pattern of retrograde degeneration of supraspinal conductors can be regarded as a sign of structural damage to short propriospinal fibers, which is probably both congenital and acquired as a result of additional excessive mechanical or other effects.

Conclusions. MR tractography is a valuable new tool for assessing the condition of the spinal cord pathways. It is obvious that the MRTOGRAPHIC picture and indicators of fractional anisotropy in various forms of spinal dysraphy may depend, among other things, on the age of the examined patients. In our opinion, it remains relevant to further search for criteria for the differential diagnosis of

functional disorders and structural damage to the spinal cord in spinal dysraphy and fixed spinal cord syndrome

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